THE FOUNDRY for April

Filling the VOID

VARIOUS estimates are being made by economists, statisticians and association executives covering unfilled demands for a wide range of machinery and equipment. Factories on reduced schedule of operation buy little and that small amount is mainly for repair. When operating losses mount, even repair parts are purloined from idle machines to take the place of broken or worn out identical pieces of the machines which are active. In consequence, a vacuum exists. Unsatisfied demand has mounted during the past five or six years in practically every manufacturing establishment.

Foundry equipment purchases constitute no exception. Arthur J. Tuscany, executive secretary, Foundry Equipment association, Cleveland, has just completed a study covering coremaking, molding, handling, melting and cleaning equipment all of which are made by members of the industry operating under the foundry equipment industry code. This shows, on a most conservative basis, an unfilled demand for foundry machinery in the neighborhood of twenty-five million dollars value.

It is significant that the basis of computation used does not take into account any other factor than the normal average buying over the past eleven years. No measure exists for determining the actual requirements to replace machines that should be replaced, the casualities of time, corrosion and the accelerated destruction of idleness. It would be impossible to estimate the loss due to sale and dismantling of plants in certain localities, and the expected needs for new machinery from firms just entering the field or contemplating extensions. Nor is it possible to even guess at the inroads made by the obsolescence factor, nor the stimulation of interest through the introduction of entirely new devices for foundry service. Likewise the pressure of necessity for meeting higher requirements in production or character of product, the shortage of skilled men, an increasingly pressing problem, and various other considerations remain entirely outside the realm of statistical forecasting of foundry equipment purchases. New equipment answers many problems.

Gray Iron TONNAGE

RECENTLY issued by the national code authority for the gray iron foundry industry, production tonnage totals for 1933 represents the first real step in statistically exploring an unknown territory. The code authority in this case has made available the annual output for a class of jobbing gray iron foundries, whose figures previously had been shrouded in the mists of uncertainty and subject to the estimating, sometimes reckless and damaging, of anyone who sought to make a point. The tonnage shown, unfortunately, does not include many lines of specialties, gray iron jobbing castings in many cases, but reported under some other code. Nor do they give totals of foundries owned and operating as departments of other manufacturering plants, sometimes referred to as *captive* gray iron foundries. With 1437 foundries reporting, a total of 783,344 tons was produced in 1933, according to the figures reported to the code authority. The production by districts is as follows:

District	No. Plants Reporting	Tonnage
Washington, Oregon, Idaho, Montana	74	9,634
California, Utah, Arizona, Nevada	76	28,861
Minnesota, North Dakota, South Dakota, Wyoming, Wisconsin	119	44,041
Colorado, New Mexico, Kansas, Missouri, Southern Illinois	81	38,590
Iowa, Northern Illinois, Northern Indiana, Nebraska	119	120,025
Michigan	91	109,865
Northern Ohio	94	78,260
Southern Indiana, Southern Ohio, Kentucky	124	65,181
Western Pennsylvania, West Virginia, Garrett and Allegheny Counties in Maryland	89	31,385
Eastern Pennsylvania, Southern New Jersey, Delaware, D. C., Maryland except Garrett and Allegheny Counties	84	45,617
Western New York, Erie County in Pennsylvania	52	32,273
Massachusetts, Rhode Island, Maine, New Hampshire, Vermont	117	44,058
Connecticut, Eastern New York	56	34,077
Northern New Jersey, Northeastern Pennsylvania	48	50,010
Texas, Oklahoma, Arkansas, Louisiana	89	15,307
Mississipi, Alabama, Tennessee, Georgia, Florida, North Carolina, South Carolina, Virginia	124	36,153
	1437	783,344

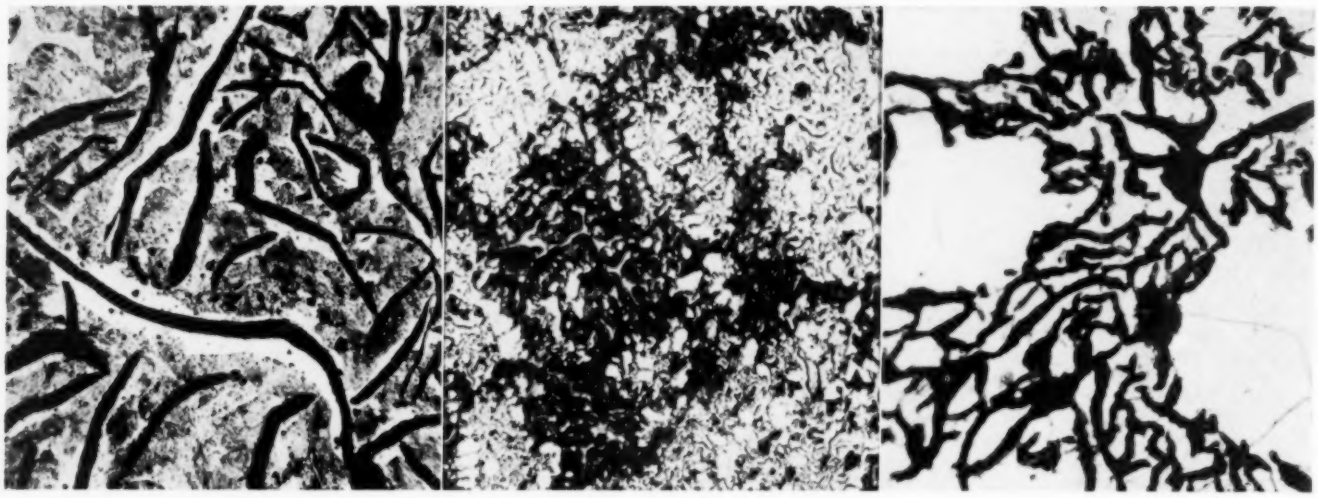


Fig. 1 Left)—Ferrite paralleling coarse graphite flakes, x100, etched. Fig. 2 (Center)—Ferrite in pseudo eutectic graphite formation, x100, etched. Fig. 3 (Right)—Ferrite in pseudo eutectic graphite formation, x500, etched

Gray Cast Iron

By JOHN W. BOLTON

Understanding of mode and formation of structure shows methods of improvement

Chapter I

SIGNIFICANCE should be attached to the fact that the improvement of gray iron from an engineering viewpoint, which has occurred in the past decade, has been concurrent with a large volume of metallographic research. The science of metallography is not confined to the study of microstructure. Metallography combines and correlates knowledge of internal structure, composition, and engineering properties. Once the significance and mode of formation of various structural arrangements are understood, the investigator has at hand a wealth of material which often suggests methods of effecting further improvements.

The terms metallography and microscopy conjure up to many the picture of a vast array of bewildering and confusing data and deep abstractions which require the knowledge of a specialist for understanding. The fact is that a working knowledge of gray iron metallography is attained readily by anyone who will vouchsafe the subject a reasonable amount of time and patience.

The term gray iron is generic rather than specific. That is, gray iron is not an alloy, but the term gray iron embraces a whole series of alloys. In composition and structure, all these alloys have certain points in common. They contain iron, carbon, and silicon. All contain free graphite flakes in the *as cast* condition. Neither steels nor malleable irons contain free graphite in the as cast condition. True gray irons also are free from appreciable amounts of *free* cementite or chill spots. Iron containing appreciable amounts of free cementite as well as graph-

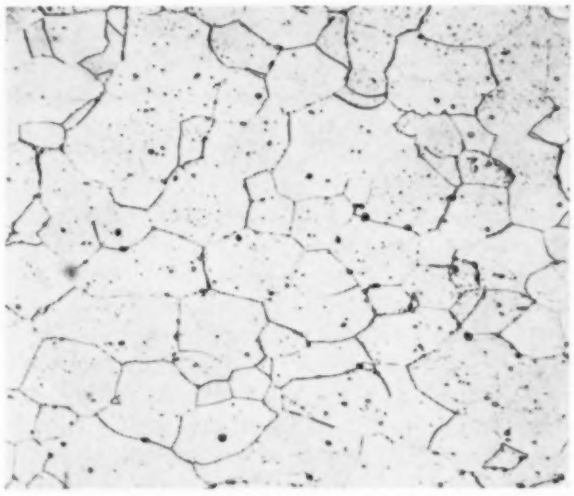


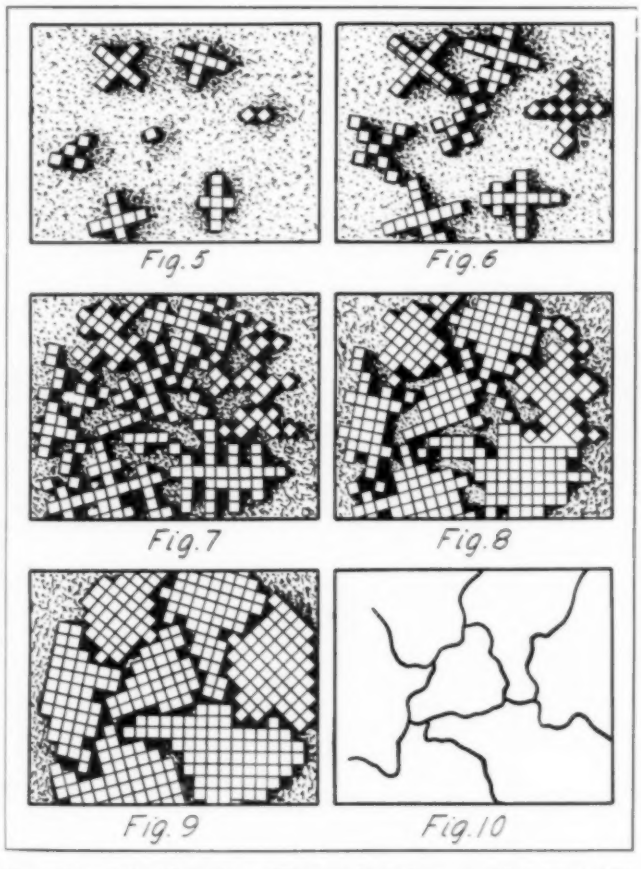
Fig. 4—Micrograph of substantially pure iron, x100, etched. Courtesy Reid L. Kenyon, American Rolling Mill Co.

ite more properly are termed mottled irons. The gray and mottled iron series merge into one another in certain ranges as will be explained later.

The vast majority of gray irons of commerce fall within the following range of composition: Carbon, 2.50 to 3.70 per cent and silicon, 0.50 to 3.00 per cent.

That composition range in itself does not identify gray irons fully. Malleable iron, for example, generally falls within certain portions of that composition range. Also, some of the special high strength irons may have carbon contents well under 2.5 per cent. Possibly it would be well to confine the term gray iron alloys to those alloys with eutectiferous percentages of carbon, i.e., to those ranges where ledeburite may be formed.

Furthermore, true gray irons are not commercially malleable as cast (either hot or cold), as is cast steel, nor can they be heat treated to give appreciable ductility—as is malleable iron. This is due to the presence, distribution and shape of graphite flakes, which are different in gray iron than in malleable iron. Theoretically it may be possible to produce an initially malleable gray iron casting, but in practice no process yet revealed has proved capable of producing a really ductile alloy. Invention of a commercially feasible process to produce gray iron possessing ductility and good strength undoubtedly would produce a revolution in the ferrous casting field.



Figs. 5 to 10—Drawings illustrating the growth of crystalline grains, according to Rosenhain

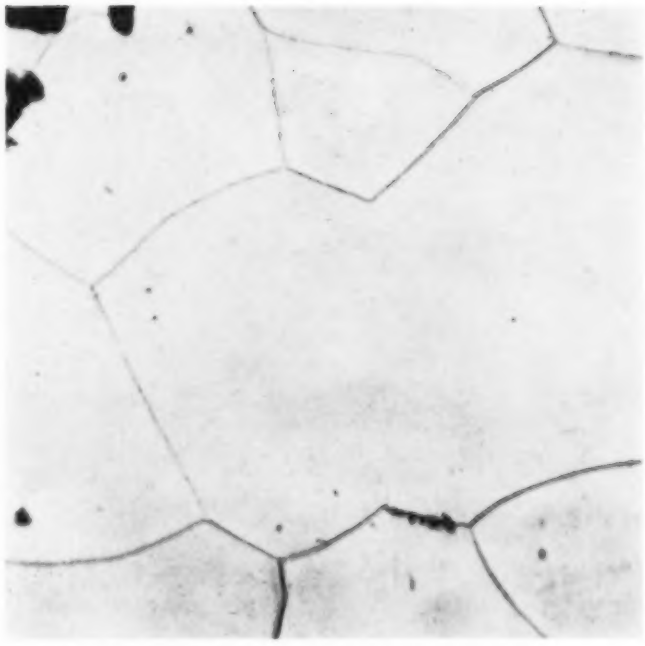


Fig. 11—Ferrite in gray iron, x2000, etched with picric acid

Beside carbon, iron and silicon, commercial gray irons contain appreciable percentages of phosphorus, sulphur and manganese. Phosphorus in American irons may range from under 0.15 per cent for some classes of work up to 1.00 per cent in others. Some foreign irons run higher in phosphorus up to 1.5 per cent being not uncommon. Sulphur ranges from about 0.008 to 0.15 per cent in the majority of commercial irons, probably averaging about 0.10 per cent. Manganese content usually ranges from 0.50 to 0.80 per cent although irons slightly above or below that range are not uncommon. Many irons of recent manufacture have had percentages of the so called alloys (more properly metals or elements) deliberately added. Among these alloys, nickel is the most widely used. Other metals usually added in alloyed form are chromium, molybdenum, titanium, vanadium, copper, tungsten, zirconium, aluminum, etc.

Some of these metals are found in certain ores, hence in the pig irons made from such ores. The nickel-chromium bearing pig irons known as Mayari irons are widely known. Other irons may contain small amounts of various metals—for example titanium in some Southern irons and copper in the irons from Cornwall ores. Gray irons also contain small amounts of dissolved and occluded gases such as oxygen, hydrogen, carbon monoxide, carbon dioxide and nitrogen.

Microscopic study shows that gray irons contain four major structural components, namely graphite, pearlite, ferrite and steadite. Chilled and mottled irons contain free cementite. All cast irons contain minor amounts of inclusions, such as manganese sulphide, etc. Structurally, gray iron consists of a coherent metallic matrix throughout which are dispersed myriads of noncoherent graphite flakes. The coherent matrix

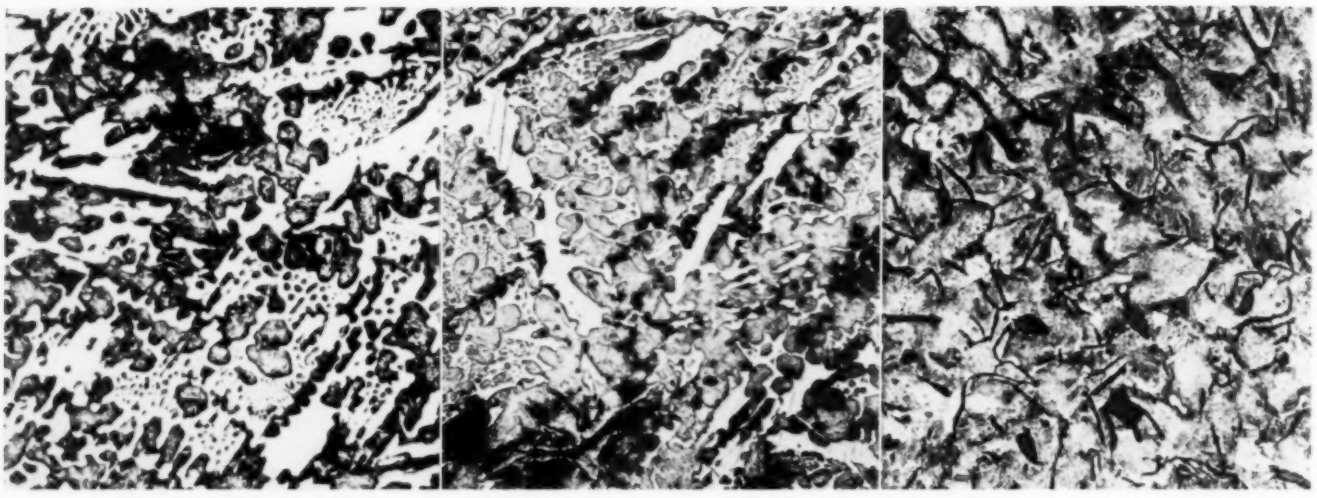


Fig. 12 (Left)—Cementite in chilled iron, x100, etched. Fig 13 (Center)—Cementite in mottled iron, x75, etched. Fig. 14 (Right)—Pearlite and graphite, x100, etched with picric acid

consists of ferrite, pearlite and steadite in various amounts, plus minor inclusions.

The structural component known as free ferrite occurs in irons low in combined carbon. Structurally it is similar to pure iron, hence the name ferrite, a term derived from the latin word *ferrum* meaning iron. Because of the presence of considerable silicon in solution the ferrite in gray iron often is known as *silico ferrite*. Pure iron, for example, in a form stable at room temperature, is composed entirely of ferrite. Presence of elements in solid solution in iron (such as the silicon of the silico-ferrite of gray iron) does not change the general nature of the structure, hence such solid solutions also are called ferrite. It is proposed to discuss the ferrite of *pure* iron first, then to describe the appearance and distribution of ferrite in gray iron. Later, the formation of ferrite in gray iron and the effect of the elements on it will be dealt with more fully.

When viewed under the microscope a suitably polished and etched sample of Armco iron (a commercially pure grade, 99.90 per cent iron) appears to be made up of polygonal (i.e. many sided) grains, Fig. 4. These grains are known as ferrite, or alpha iron. Ferrite in gray iron is shown in Fig. 11. Metallographists have known for many years that the polyhedral grains of alpha iron or ferrite are built up from cubical crystals. The cubical crystallization was suggested by the cubical etching pits revealed by deep etching and by other observations. Osmond also showed that crystals of pure iron, obtained from reduction of an iron salt, ferric chloride, are cubic. More recently x-ray studies have confirmed the earlier opinions, and show that the unit crystal of alpha iron is cubic, and possesses a body centered cubic structure. As shown in Fig. 18 this unit crystal or cube is composed of 9 atoms of iron, arranged as illustrated. This body centered cubic lattice has a parameter of 2.86 Angstrom units, according to A. W. Hull.

Thus the polyhedral grains shown to exist by the polygonal network formation in Fig. 4 are built up of cubic crystals of iron. If a crystal of iron were free to grow without interference from surrounding crystals, that crystal would be cubical. Such a fully developed crystal allowed to form without interference is known as an idiomorphic crystal. However, there is interference from other crystals in process of formation and free development is not possible. A crystal so formed cannot preserve its natural

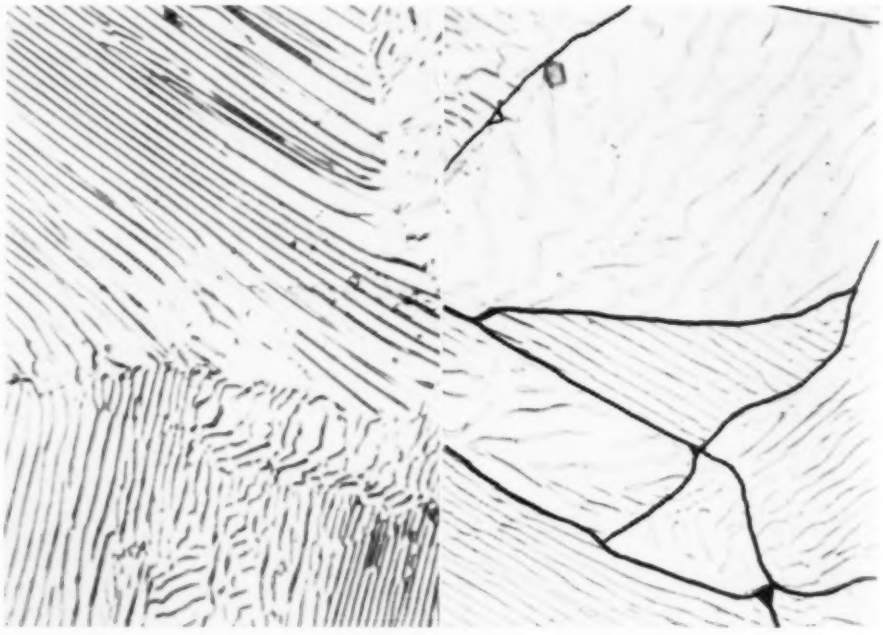


Fig. 15 (Left)—Pearlite shown as a composite structure, x2000, etched. Fig. 16 (Right)—Grain boundries in pearlite, x2000, etched

geometrical form and is known as an allotriomorphic crystal or grain. The mechanism of this is illustrated in Figs. 5, 6, 7, 8, 9 and 10 after Rosenhain.

As molten metal is cooled to the freezing point a few cubical crystals separate out, Fig. 5. Further crystals forming attach themselves to the first formed or nuclei crystals, Fig. 6. In metals such as iron, these crystal additions tend to build up in the familiar dendrite formations, Fig. 6, 7 and as that process of growth proceeds it is obvious that the space between dendrites becomes smaller, Fig. 8. These dendrites grow and fill in available space until the different groups have no further room for growth, and the supply of liquid metal is exhausted, Fig. 9. The result is an aggregate of polyhedral grains, indicated by the polygonal network formation, Fig. 10.

In the process of grain formation most impurities present are rejected to and concentrated at the grain boundaries. Then too, the grain boundary structure is somewhat different from that of the balance of the grain; hence etching usually attacks the boundaries somewhat more rapidly and makes the network formation evident.

The polyhedral grains of iron shown are in reality random in orientation. This is shown up by rather heavy etching, when the polygons appear differently, some dark, some bright and the balance intermediate. Sauveur explains this as follows "Each allotriomorphic crystal (grain) is made up of crystalline matter similarly oriented in the same grain, but differently in different grains."

The ferrite of pure iron is soft and ductile. Jefferies and Archer give the following properties:

Tensile strength, pounds per square inch	38,000
Elastic Limit, pounds per square inch	18,000
Elongation in 2 inches	51 per cent
Reduction of area	84 per cent
Brinell hardness (3000 kg)	70

Fig. 17—Spheroidal pearlite, from gas liner after 17 years service, combined carbon 0.80 per cent, x2000, etched. Courtesy R. S. MacPherran, Allis Chalmers Mfg. Co.

The modulus of elasticity (E) of ferrite is about 30,000,000. The specific gravity calculated from x-ray data is 7.92.

Ferrite is capable of holding various elements in solid solution. In gray iron containing ferrite the principal element in solid solution is silicon, hence the term silico-ferrite applied to the ferrite of gray iron. Alpha iron (ferrite) cannot hold more than a few hundredths per cent of carbon in solid solution. While pure iron can hold considerable phosphorus in solid solution, the presence of other elements (notably carbon) in gray iron inhibits the solubility of phosphorus in the silico-ferrite under ordinary conditions. Certainly in the ferrite of true gray irons the amount of (*Please turn to page* 48)

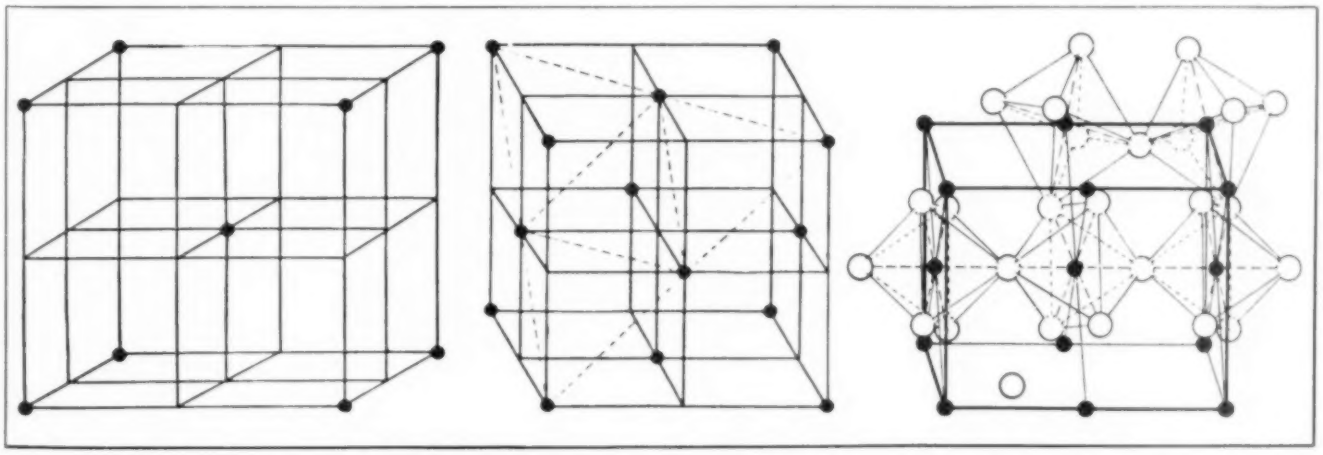


Fig. 18 (Left)—Space lattice of alpha ferrite, according to Hull. Fig. 19 (Center)—Face centered space lattice, according to Hull. Fig. 20 (Right)—Crystal structure of cementite, according to Hendricks. Carbon atoms represented by solid circles and iron atoms by open circles

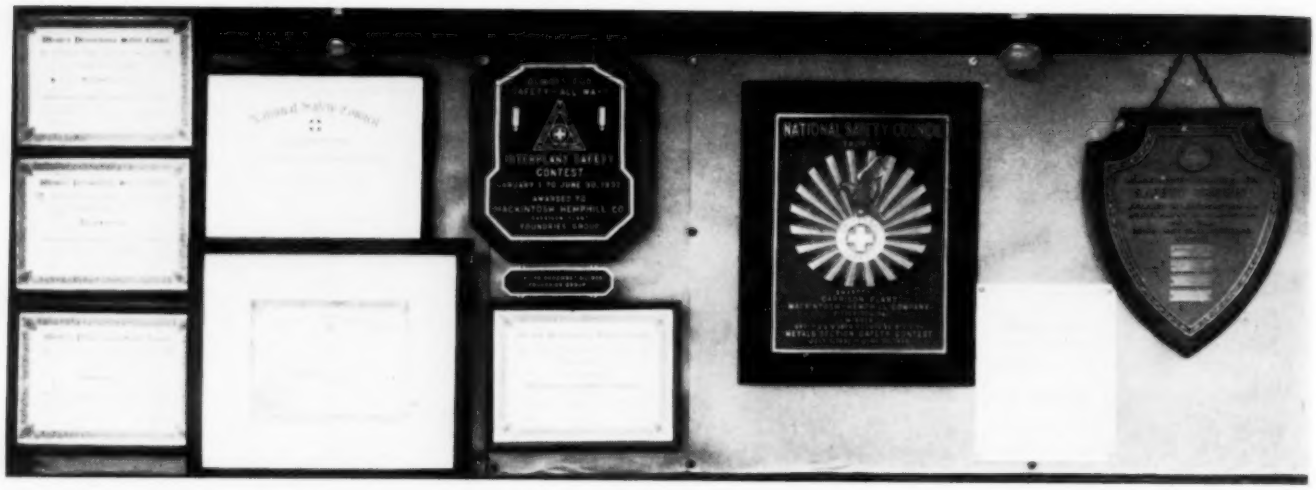


Fig 1—Display of trophies won in various contests incite management and employes to greater effort

Safety Program Shows Results

Records over a period of four years show astonishing drop in lost time accidents

FORMER tentative and more or less unrelated effort to inculcate safety first principles among workmen in the three plants of the Mackintosh-Hemphill Co., Pittsburgh, culminated in Nov. 1930 when the management decided to take more definite action. A compilation of records of accidents in all three plants for the preceding nine months showed 709 first aid cases, 249 doctor cases, 57 lost time accidents, 5 hospital cases, 1 fatality and a total of 6672 lost time days. Further analysis of the doctor cases indicated that 75 involved the eyes while the foot accidents totalled 34.

A new department was established and placed in charge of a safety director who appointed safety committees and arranged monthly meetings. General meetings were held in all plants at regular intervals. Outstanding speakers at these meetings stimulated interest in accident prevention. Suitable guards were installed near machinery and other hazardous places.

The foreman training course of the National Safety council was employed at the foremens' meetings. This was supplemented by a program of questions of direct importance to the local plant operation. The agenda for each meeting presented something definite and constructive for discussion. Posters were placed on the (*Please turn to page* 54)

Fig. 2—Goggles save the eyes and in many instances the lives of the men wearing them

Interest High in Contest Start

Foundrymen compete for cash prizes by contributing articles on foundry progress

BEFORE the end of March, the first articles arrived to be entered in the Foundry Progress Contest, announced in the issue mailed on the fourteenth of that month. These early arrivals indicate the accuracy of the estimate of the editorial staff and justify their faith in the number and value of new developments arising during the slack period in the industry. Stagnation in business always has been productive of many and valuable ideas. Progress in methods and materials thrives upon a condition which permits a more thorough study and more careful thought. Adversity impresses on all a greater need for improvement in product or economy of production.

Scanning the files of THE FOUNDRY for the past forty years is evidence of this fact. Emerging from every low point in the valleys of past business depressions, the foundry industry has brought forth those new ideas upon which further advancement has been built. New machines, new methods, new materials and a wide adaptation of contributory improvements have accompanied each period of recovery. And with them have emerged upon the scene, new names and faces, those of men who by their thought and effort have brought to the industry the sound foundation structure for further progress. Men like metals are improved by the trying fires.

Means of Exchange Limited

Previous to 1892, no medium for the introduction or exchange of these new ideas existed. Before John A. Penton established THE FOUNDRY in September of that year, ideas were exchanged only by those who traveled from shop to shop and worked in those dissociated plants that soon were to form the nucleus for the foundry industry as it exists today. Prior to that period no means existed for the quick dissemination of facts and ideas. Progress limped upon the feeble staff of personal contact. Even among those who traveled most the opportunity to see, to learn and to develop was limited.

In the field of equipment, the man-to-man method and personal correspondence alone acquainted the chance customer with the invention and improvement of the limited number of mechanical aids available. And among the personnel both of the foundry and equipment or supply industries, acquaintance was meager and scattered. Except for the publisher of the small paper founded in 1892, it is doubtful if more than two or three men knew even the names of all those who made and sold the materials and equipment required or more than a few of those who composed the foundry industry.

The first introduction of processes and machines, regarded today as indispensable, metallurgy from the first feeble steps toward mixing by analysis to the advanced alloy technique of 1935 all are reflected in back issues. A study of the files discloses articles recounting each successive step, and each innovation brought its attendant train of improvement and perfection. On the two pages immediately following, a limited number of such articles are noted, each a "famous first" significant of changing trends and important contributions to the advancement of the foundry industry.

Information Spread Rapidly

Today celerity speeds the knowledge of each new development. Every new idea in production methods relating to castings is quickly available. Each new suggestion quickly draws as to a nucleus a throng of other ideas. The accumulation, gathered and disseminated through the pages of THE FOUNDRY represents the onward sweep of the industry's progress.

Month by month the moving finger writes. The record is not closed but a new page is turned afresh. The value of a new development may not be readily apparent to the one who has conceived the idea. Some phase of foundry practice of great value to the industry may await only a thought, contributed perhaps from some source entirely dissociated. The interchange of ideas is the important element in progress.

In recognition of this fact, the publishers of THE FOUNDRY have inaugurated a contest, first announced on page 41 of the March issue. Cash awards are offered to encourage those who contribute new ideas. These are to be rewarded by cash prizes in excess of regular space rates, $100 for first, $50 for (*Please turn to page* 53)

Famous Firsts

1—The first issue of The Foundry, Sept., 1892. 2—The first foundry association, one year old, Dec. 1892. 3—The first test method, Jan. 1893. 4—The first books. 5—The first power molding machine. 6—The first American casting, 1642. 7—The first sandblast, Feb. 1896. 8—The start of the A.F.A. 9—Work hardening iron, April, 1896.

In The Foundry

10—The first conveyor. 11—Large scale electric steel. 12—Annealing gray iron, June, 1915. 13—The War opens. 14—Why motor cars developed, July, 1917. 15—International contact established, June 15, 1919. 16—Sulphur control in iron, Nov., 1898. 17—Rotary coal furnaces, July, 1931. 18—Cupola technique, and, 19—Dr. Moldenke on cast iron, Nov., 1898. 20—Good Housekeeping. 21—Foundry schools, Aug. 1915. 22—Die Casting, June, 1917. 23—Electric brass, July, 1918. 24—Sand control, June 15, 1922. 25—The sandslinger

Determines Iron Lost in Melting

Analysis of the gas produced in the cupola forms basis for calculating the iron loss

By WILLIAM McCONNACHIE

CUPOLA melting losses vary considerably, and as metal generally is more costly than fuel, it is of interest to ascertain to what extent exactly this form of loss is unavoidable.

All such wastage is to be found in the slag but slag rarely is examined, and even when examined throws no great light on the subject, since there are so many variables beyond estimation or control. We cannot know exactly how much oxide of iron was charged as oxide scale on the pig iron itself, or on the scrap, or the composition of this oxide.

While slag examination yields no great instructive information, we have the means of determining the exact amount of loss through oxidation in the cupola, by an analysis of the gas.

Mark Loss of Oxygen

Evidently if the metal is oxidized some oxygen will be taken out of the gas. The average blast contains with every 100 volumes of nitrogen, 26.5 volumes of oxygen. On testing the gases leaving the cupola, if we find any lesser proportion of oxygen, we may be sure that loss to that extent has been incurred, through contact with blast oxygen, or hot carbonic acid.

An interesting comparison of operating data on two 54-inch cupolas is presented in Vol. XXII *Proceedings* of the Institute of British Foundrymen. These cupolas in the same plant were used on alternate days. One was of the ordinary type. The other had been converted to the Poumay system. The general impression given by most of the data is that the change was well worth while, since only 71.7 per cent of the coke was needed, and the rate of melting was about 25 per cent faster, while the metal was hotter and contained less sulphur. The item of wastage was not considered.

Analyses of the gas samples drawn at charging door level—average of three tests of each—are shown in Table I.

To determine from the analyses if any of the oxygen is missing, we have to convert the volumes of CO_2 and CO into the equivalent volumes of oxygen. CO_2 occupies the same volume as the oxygen which produced it, while CO has twice the volume of the contained oxygen. The summated oxygen, by volume thus obtained for Poumay is — 18 volumes in CO_2 + 0.06 volumes in CO + 0.37 volumes free, equal to 18.43 volumes with 81.51 volumes nitrogen, the latter considered as derived entirely from the blast, and as passing through the cupola unchanged.

Converting this to volumes of oxygen per 100 volumes of nitrogen, for easy comparison, we get $\frac{18.43 \times 100}{81.51} = 22.61$ volumes oxygen instead of the 26.5 volumes in the blast, showing that 3.89 volumes have disappeared, equal to 14.67 per cent of the 26.5 present in the blast.

In similar fashion we find the summated oxygen in the gas from the ordinary furnace to be 12 2/3 + 1/3 + 5.25 = 18.25 volumes oxygen with 76.51 volumes nitrogen equal to 23.85 volumes O_2 with 100 of N_2, showing a loss of 2.65 volumes or exactly 10 per cent of the oxygen of the blast.

Before deciding whether more or less metal was oxidized in the Poumay than in the ordinary cupola, it is necessary to figure the amount of blast oxygen used in each case. This may be had from the gas (*Please turn to page* 56)

Table I

Gas Analyses from Two Cupolas

	By difference			
	CO_2	CO	O_2	N_2
Poumay	18.00	0.12	0.37	81.51
Ordinary	12.66	10.52	0.33	76.51

Table II

Oxygen Taken up by Elements

Iron as melted	Burned to	Oxygen taken for 1 part	Oxygen taken up	
Carbon 3.5	CO_2	2.66	9.345	11.145
Phosphorus 0.8	P_2O_5	2.25	1.8	
Manganese 0.8	Mn_2O_3	0.4	0.32	
Silicon 1.7	SiO_2	1.14	1.938	38.606
Iron 93.2	Fe_2O_4	0.39	36.348	
100.00			49.751	

Analyzes Profits by Customers

Monthly reports reveal value of business transacted with the individual purchasers

By ALBERT E. GROVER

THE jobbing foundryman should be and usually is concerned about profits secured from individual customers. Therefore, the method of reporting customer profits shown in the following discussion should be of considerable interest, since it is comprehensive and extremely simple to produce.

This form is one of a group of reports for executives arranged in a similar manner in a multiple ring binder. One master and 12 detail report sheets are prepared for the year's reporting. The master sheet is ruled to correspond with the form on the detail sheets, as indicated in the accompanying illustration. The two forms are different in color (master blue and detail sheets white).

At the close of business for January, a detail report is placed in the top position over the master sheet, leaving the *Budget* figures exposed. As shipments are made during the month, the estimated cost of each job is entered on a copy of the sales invoice. At the close of the month's business these sales invoices are: 1—Sorted by customers; 2—Weights, sales values, and estimated costs added for each customer and the totals entered on the detail report.

Actual costs are kept separately for each customer, and the amounts are entered on the report at the close of the month. Separate pattern costs are maintained on most of the customer's work, but certain miscellaneous small orders are grouped into one cost calculation. This action is governed entirely by individual circumstances.

Using company *D* as an example, unit costs and profit are arrived at as follows:

Shipments	60,000	pounds
Divided by total shipments	450,000	pounds
Equals percentage of total business	13	per cent
Sales value	$2,400.00	
Divided by pounds shipped	60,000	pounds
Equals average sales price per pound	4	cents
Standard cost of jobs shipped	$2,000.00	
Divided by pounds shipped	60,000	pounds
Equals average standard cost per pound	3.3	cents
Actual cost of jobs shipped	$2,800.00	
Divided by pounds shipped	60,000	pounds

(*Please turn to Page* 64)

	SALES				COST				PROFIT				
CUSTOMER'S NAME	WEIGHT Lbs.	%	VALUE	A.S.	STANDARD AMT.	U.C.	ACTUAL AMT.	U.C.	STANDARD AMT.		ACTUAL AMT.		TOTAL AMT.	
BUDGET	$500000		$25000	050	$22500	045	$21250	042	$2500	005	$1250	003	$3750	008
A	10000	2	$1000	100	$800	080	$700	070	$200	020	$100	010	$300	030
B	200000	45	10000	050	8500	042	8500	042	1500	008			1500	008
C	100000	22	6000	060	5400	054	6000	060	600	006	(D) 600	006		
D	60000	13	2400	040	2000	033	2800	047	400	009	(D) 800	014	(D) 400	007
E	80000	18	4400	055	4000	050	3500	044	400	005	500	006	900	011
JANUARY	450000	100	23800	053	20700	046	21500	048	3100	007	(D) 800	(D) 002	2300	005
FEBRUARY	416000	100	22880	055	18720	045	17888	043	4160	010	832	002	4992	012
FEB.—TO DATE														
MARCH "														
APRIL "														
MAY "														
JUNE "														
JULY "														
AUGUST "														
SEPT "														
OCT "														
NOV "														
DEC "														

Report showing profit analysis by customers

Fig. 1—At periodic intervals the accumulated dust is removed from the floor

Cleans Foundry with Vacuum System

Hose attached to suction line collects dust from walls, beams and shop floors

By PAT DWYER

IN ONE of the famous sketches published many years ago, Mr. Dooley, sage of Ar-r-chey Road, Chicago described his experience while riding in a Pullman sleeper to attend the Louisiana Purchase Exposition in St. Louis. The train was crowded and as a result Mr. Dooley was cruelly knocked about, mentally and physically.

"The j'ys iv thravel" he confided to the faithful Hinnesey "are gra-a-ately overistimated. If iver agin—which God forbid—I feel the wild desire to thravel I'll thrip over the coal hod, climb up on a shelf in a cupboard undther the stairs, shtick a cindther in me eye an' go to sleep."

Modern Pullmans, steam heated, air conditioned and window screened probably would induce Mr. Dooley to amend or tone down his distinctly adverse opinion. Casting about for a comparison, the direct antithesis of a Pullman car, one might designate a foundry where the character of the materials used and the fluctuating temperatures naturally create a dusty atmosphere. For many years this was accepted as a natural condition in common with inadequate lighting, hard back breaking labor, low roofs, broken windows, open salamanders in

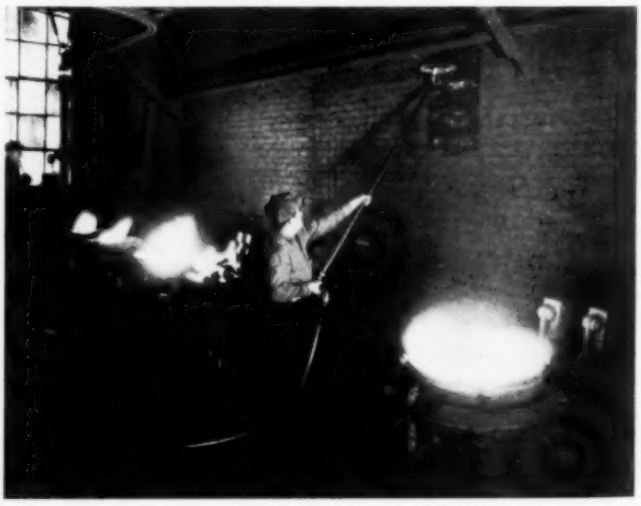


Fig. 2—Telescope extensions on the pipe enable the operator to remove dust from the walls

winter and a free and easy random type of open plumbing.

Modern foundries are well lighted, heated, ventilated, provided with locker rooms, shower baths and sanitary toilet facilities and constitute as great a contrast with the average shop of Mr. Dooley's day as do the Pullman cars of the same period. Mechanical equipment to a remarkable extent has lifted the age old burden and replaced manual labor. Dust and smoke, accompanying the melting of metal at high temperatures and pouring it into sand molds, have not been eliminated entirely, but methods and equipment have been installed to correct the discomfort of dust, smoke and steam.

Dust Removed by Suction

An outstanding example of the extent to which these practically can be removed from the air is presented in the foundry department of the Sloan Valve Co., Chicago. Two separate systems are employed. One, a low velocity suction system engineered and designed by J. R. Allan and Frank H. Amos, Chicago, collects and removes the dust and gases generated at the mold shakeout, core knockout station, and points in the sand preparation and conveyor system. This system utilizes the conventional sheet metal suction pipes with a bag type dust arrester. Suction is supplied by a 55-inch fan located outside the building.

A free hand sketch of the foundry floor, Fig. 6, not drawn to scale, shows the general layout and the location of the various operating units in relation to each other. The two duplicate mold shakeout units occupy a space close to each other at the left. A description of one and the manner in which the dust is removed will serve for both.

Molds are shaken out over a grating which allows the sand to fall through, but which retains the flasks and castings. The flasks are returned to the conveyor and the castings are loaded in small trucks and taken to the vicinity of the core knockout apparatus indicated in the upper left corner. From that point they travel to the water tumbler, then to the sprue cutters and grinders and finally to the machine shop.

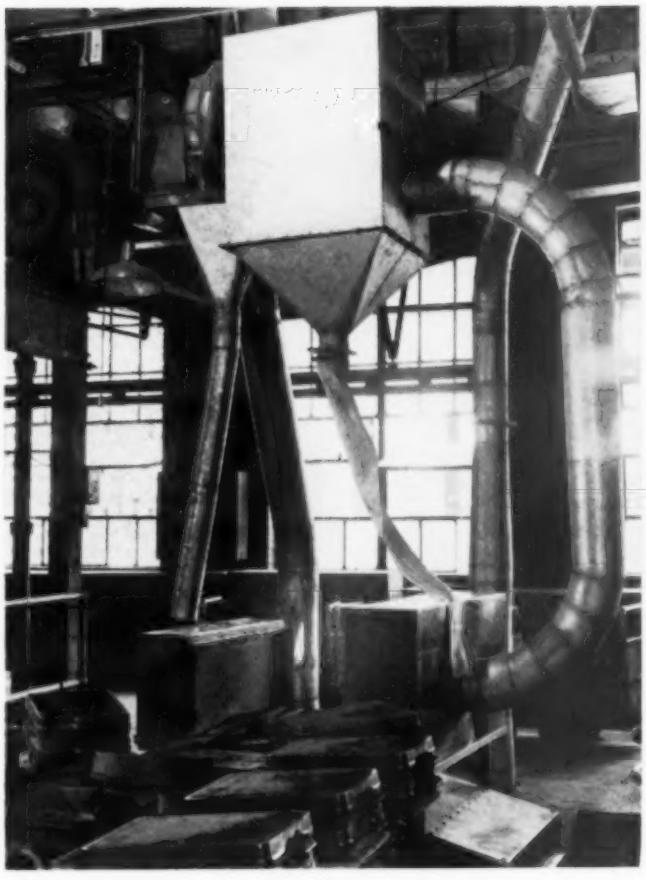


Fig. 4—Blast from the smaller box drives the dust to the suction box on the opposite side of the shakeout

Fig. 3—A hook attached to the ring prevents the crucible from falling out of the bail suspended from a monorail

A wide belt under the shakeout screen carries the sand to an elevator from which it is discharged at the top into sand preparation and distribution equipment supplied by the C. O. Bartlett & Snow Co., Cleveland. The system high above the floor extends over the two batteries of molding machines to which the sand is delivered through suitable chutes as shown in Fig. 1. The low velocity suction system collects the dust which arises at the mixing station where the sand passes through a screen and revolving lantern wheel and other dust creating points throughout the foundry.

The principal features of the shakeout dust remover are shown in Fig. 4, a fan and dust

Fig. 5—A monorail extends above the battery of furnaces and facilitates distribution of the metal to the various pouring stations

collection chamber above, blower and suction box below, one on either side of the shakeout grating. One of the unique features of the installation is that the fan serves both as a blower and exhauster. The air is kept in circulation. Dust laden air from the box at the lower right is drawn upward through a pipe connected to the dust extraction chamber in the upper center. The dust remains in that chamber and the dust free air is drawn into the fan and discharged through a down pipe into the steel blower box at the lower left.

A constant current of air escapes from the box through a narrow slot in the face extending around both ends and the top. The blast is directed in a horizontal direction by a narrow rim or hood which projects from the edge of the box. Dust arising from the operation of shaking out the molds is enveloped by this thin, moving air formation and directed into the funnel face of the box on the right. Dust and air enter the funnel connected to the pipe on the extreme right which discharges into the dust collection chamber at the top center.

An auxiliary blast pipe below the floor level delivers air to the box chamber surrounding the funnel. This air escapes through a number of small openings located close to the perimeter of the box and supplements the stream of air coming from the opposite side of the shakeout in directing the dust laden air into the center of the funnel. At periodic intervals the dust collection chamber at the top center of the installation is emptied through a length of canvas hose attached to a nozzle at the bottom.

To prevent the fans at the shakeout station from becoming contaminated with fine dust, bleeder pipes are connected to the low velocity system, which collects practically all the floating dust in the foundry.

The second dust removal unit is a vacuum system installed by the Spencer Turbine Co., Hartford, Conn., and collects deposited dust from various points in the building, walls, floors and beams.

Nozzle End May be Extended

A pipe line connected to that vacuum system extends to all parts of the foundry with suitable connections at strategic points for attaching a length of hose provided with a suction nozzle. The apparatus is similar to that employed in hotels and other large buildings where the floors are carpeted. A single length of light steel pipe extends from the end of the hose to the collection nozzle and is sufficient while the operator is cleaning the floor or the lower part of the walls. One or more additional lengths of pipe in which the end of one pipe slips into the end of the adjoining section, enable the operator to remove dust from the beams and from high points on the walls. A small brush located in the mouth of the nozzle facilitates the removal of the dust. The smooth concrete floor is vacuum cleaned at periodic intervals throughout the day.

The foundry is part of a large plant engaged in the production of a special type of flush valve originated by the founder of the Sloan Valve Co. Casting inspection features are exceptionally high and as a result operating technique has been developed to a high degree. Desire to maintain a clean shop free from atmospheric contamination reflects the belief of the management that cleanliness of personnel and environment is a decided factor in the production of clean castings.

Metal is melted in a (*Please turn to page* 58)

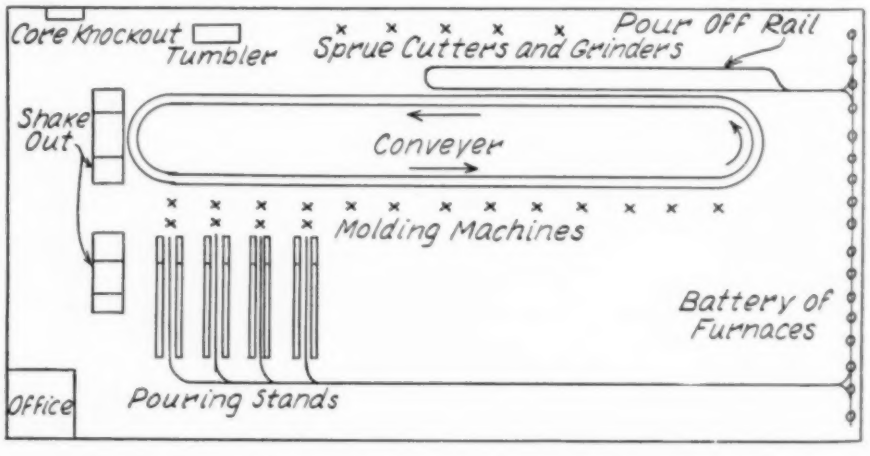


Fig. 6—General floor plan showing location of the various units

Advocates Round Grain Sand

High sand permeability is the principal factor in production of steel castings

By D. D. CAMERON

A SAND cleaning system not only saves and cleans sand, but it is the basis for uniform batches of sand in grain size, permeability, bond strength and moisture content. There are elaborate sand reclaiming and conditioning systems with dust arresters, hoppers for storage and core crushers for salvaging core butts, not to speak of magnetic pulleys and separators. All these accessories help a lot but they are not absolutely essential, particularly where a plant is not operating to capacity.

A small compact unit economically will produce a cleaned well bonded sand from the muller, a fool proof facing that will stand hard ramming and produce perfect castings, assuming of course the steel is good. Saving on new sand and binders, better castings soon will pay for the installation without taking into consideration hauling of new sand into the plant and hauling used sand to the dump.

Many things can happen in a foundry to produce imperfections in steel castings, including pin holes, porosity, cutting of the mold face due to small areas of the mold where the permeability is low or uneven, probably caused by mulling the batch of sand an insufficient length of time. Mullers set too high, plows not set properly, or using a pan type mill to grind the sand and clay to dust, destroy the natural permeability which sand and certain clays will give, provided they are mulled properly and not ground. A lean fireclay and not a fat fireclay is the only clay to use. When the cleaned sand, fireclay and binder are mulled in a dry state for at least a minute before a determined amount of water is added, the facing is correct inasmuch as the clay is wrapped around the grains of sand. Water in contact with fat clays immediately forms small balls or patches, does not permit even distribution of the clay and does not coat the grains of sand properly.

The fat fireclay immediately grabs the water and regardless of the mulling time, a proper distribution of the clay is not possible. The casting from a mold in which fat clay facing is used will show blows. Weakness of the sand causes cutting or erosion and this cut or eroded material contaminates the steel. A fine or pulverized clay not only grabs the moisture and forms wet, plastic balls, but a great portion goes out through the dust arrester over the mills.

I prefer a gritty type clay in which 100 per cent must pass through a 24-mesh sieve. This clay helps to maintain a high permeability and favors a high moisture content, around 5.30 per cent. This figure reacts still further and means the silicon content in the steel must be kept up to at least 0.35 per cent. As a matter of fact the silicon content is kept consistently between 0.40 and 0.45 per cent.

Avoid Low Permeability

Low moisture content is not a cure for casting defects usually blamed on steam and sweating. Steam or sweat will not occur when the permeability is high enough, say 325 or higher. The claim that steam generated by pouring metal into a mold causes defects is true only for a low permeability sand. A moisture content of 3 to 3.25 per cent will not permit hard ramming. The openings in the sand are not sufficient to allow the steam and gas to escape properly.

Hot sand is necessary to create dust for the vacuum system to carry away. Cold and clammy dust clings to the grains while passing through the cleaner. Later after it has dried it comes in contact with warm sand. The dust separates from the sand grains and trouble may result in the form of burned on sand and other forms of weakness in the facing. In the absence of hot sand as the result of intermittent operation, or the lack of heavy castings, it is advisable to run the cleaner system and keep the sand passing through. This will carry away a major portion of the dust which otherwise would lie dormant and cling to the sand grains. The foregoing applies particularly to large systems, but would not affect to any noticeable degree a smaller more compact unit.

Many published statements claim that a high permeability, 325 to 450, will produce rough castings and cutting of the mold face, especially where a large quantity of metal flows over a given area. I do not (*Please turn to page* 62)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Bearing Bronze Bushings Are Made Chiefly in Sand Molds

Do you have information on casting bronze bushings made from 80-10-10 per cent metal varying in size from 2 to 5 inches in diameter and 12 inches long, solid, in steel or iron molds? Also do you have any information on casting bronze bushings of the same metal, but with cores varying from 1 to 2 inches in diameter and 12 inches long.

Production of bearing bronzes, such as 80-10-10, in permanent or even semipermanent molds, has been tried time and again. In a number of instances exceptionally satisfactory castings have been produced, but expense of production has been all out of proportion, since the mold life is short, and the number of good castings resulting is such a small proportion of the total produced. Therefore, bearing bronze bushings are made in sand molds, although sometimes the cores are made of metal and so designed as to collapse to permit removal. Even such cores, increase the cost and the number of defective castings materially.

With modern methods of precision tooling and rapid production in the machine shop, it is far more economical to cast bearing bushings in the sand and thereafter machine them to the desired accuracy than attempt to cast them to a degree of accuracy in permanent or semipermanent molds. If casting them in these permanent molds is not demanded by accuracy requirements but because of the hope of reducing the cost of production, experience proves that it costs materially more to produce these bearing alloys by this method as compared to sand casting.

These bearing alloys are hot short or brittle at elevated temperatures and therefore, give trouble as compared with the metal mold casting of alloys like aluminum bronze or Muntz metal, which are not so brittle at elevated temperatures.

Suggests Higher Head On Steel Roll Shell Casting

We are having trouble with shrinkage in a steel roll shell casting 55 inches diameter, 6½ inches thick and 20 inch face. The mold is made in dry sand cores and is carried up to a height of 28 inches to give an 8-inch head on the casting. This head of course later is cut off in the machine shop. The mold is open on top and is mounted on a revolving table where the metal is poured from a stationary ladle.

Apparently you are pouring metal into the mold under ideal conditions to secure a solid homogeneous casting. The revolving mold insures a constant and steady supply of metal to the entire casting thus promoting uniform temperature. By pouring hot metal from the top you promote the ideal condition in which metal solidification progresses steadily from the bottom to the top. Under these conditions we should anticipate the production of a clean, solid casting even under an 8-inch head. However, if the casting actually shows shrinkage, the obvious remedy would seem to be an increase in the height and possibly in the thickness of the head metal. Try a head 10 inches thick and 12 inches high for a start and note the result. Probably this head may be reduced somewhat on subsequent castings.

Metal Must Be Melted Properly And Introduced into Mold Quietly

We have a bronze casting weighing approximately 500 pounds of the following analysis: 75 per cent copper; 20 per cent lead; 5 per cent antimony. It must be homogeneous and free of blow holes. Any information you can give will be appreciated.

To insure a sound, clean, satisfactory casting in that alloy, every care should be exercised in melting. Gating should insure a quiet flow of the metal into the mold, eliminating any possibility of turbulence during the flow of the metal.

Sufficient risers should be provided to insure proper feeding, as the alloy will shrink considerably.

Melt in an atmosphere that is definitely nonreducing; that is, a slightly oxidizing atmosphere must be used so that there are no under burnt gases to be absorbed. Melt as rapidly as possible so as not to expose the metal to furnace atmosphere any longer than necessary. In other words, speed helps to safeguard the alloy against gas absorption. There is no possibility of a good casting unless the metal is melted correctly.

A well dried mold will be of material help in insuring a good casting. Skin drying a mold containing 500 pounds of castings, plus gates and risers of several pounds more would be taking chances that are not warranted. The mold should be well blacked with a good grade of graphite.

The proper pouring temperature is difficult to specify, but it is desirable to pour such heavy castings at as low a temperature as will permit running the casting readily. Metal should not be heated in the furnace any higher than is absolutely necessary.

Physical Requirements High For Particular Analysis of Metal

We are making castings containing 86 per cent copper, 9 per cent tin, 4 per cent zinc and 1 per cent lead, and are required to get the following physical properties: Tensile strength, 37,000 pounds per square inch; elongation in 2 inches, 30 per cent; and reduction in area, 30 per cent. We are able to get the tensile strength but fall down on the elongation and reduction of area. We will appreciate information on how to meet these specifications with the exact formula shown.

The physical specifications are rather high for the alloy, insofar as elongation and reduction of area are concerned. Ultimate tensile strength is reasonable and in fact this alloy should develop even higher ultimate strength on the average. It may be possible in some instances to secure the high elongation; but with 1 per cent of lead, the chances are the reduction of area would be difficult to secure.

If this alloy is melted carefully so as to prevent any possibility of gas absorption during melting, it may be possible to secure as high an elongation as 30 per cent and in some instances a reduction of area of 30 per cent.

We believe, however, that there must be some error in the specifications that require 30 per cent elongation and 30 per cent reduction of area. Of course, if the lead is kept at the absolute minimum permissible under the chemical specifications, the tin and zinc held at the high limits of the specifications, and the melting done carefully, these physical characteristics may be developed in test bars that are properly fed by adequate risers. A reduction of area of 20 per cent and an elongation of about 20 per cent would be more reasonable for this alloy.

Considers Efficiency As Determined by Melt and Remelt

We operate a hot air and hot water furnace foundry and have been puzzled to account for the wide variation at times in the relation of the remelt to the total amount charged in the cupola. What percentage of remelt represents efficient practice in a foundry of this kind.

Under normal operating conditions the daily report for the average hot air and hot water furnace foundry shows: Metal charged 100 per cent; good castings 65 per cent; furnace loss 5 per cent; defective castings 5 per cent; gates, sprues, miscellaneous scrap and over iron 25 per cent. Among these various factors the furnace or melting loss practically is the only constant. Percentage of defective castings will vary from day to day, and under exceptionally adverse conditions may reach alarming proportions.

Any change in the relative proportion of heavy and light castings poured on any given day will be reflected in the volume of gates and sprues. In proportion to their weight, light castings require heavier gates and sprues than heavy castings. Fluctuation in temperature of molten metal will be reflected in volume of defective castings and also in amount of iron in pig molds. Amount of iron in the cupola drop may fluctuate, depending on ability, or lack of ability on the part of the man responsible for ordering the total amount of iron to be charged into the cupola on any given day. All these factors must be taken into consideration in estimating or determining efficiency of operation.

Cupola Melting Loss Increases With Small Heats

In melting from 24 to 34 one-ton charges our cupola loss shows less than 3 per cent. When running heats of 13 one-ton charges the loss is about 4.5 per cent. We are inclined to the opinion that the smaller heats should show the smaller loss and will be interested in having your comment on the subject.

The difference of 1.5 per cent in the cupola melting loss between large and small heats may be due to any one of several variable factors. Under laboratory conditions a person might be in position to determine accurately the actual weight of iron lost through melting, but under actual operating shop conditions, this item necessarily must be estimated to a certain extent. Melting loss on certain kinds of iron greatly exceeds that on other varieties, but if you have made no change in the character of the charges the percentage of loss on a long heat should not

differ from the percentage of loss on a short heat.

Basing an opinion upon a knowledge of operating conditions we suggest that a close check will show that discrepancy exists between the actual weight of materials used and the weights shown on the report cards. A 1-ton charge as marked on the card, may vary from 1980 to 2020 pounds in the cupola. According to the low of averages the over and under weight charges should work out even and yield the anticipated total. However, in some instances the charges will run consistently heavy and in other instances they will be light. Naturally any melting loss figured against such a shifting variable will not be accurate.

Castings Must Be Clean for Lead Coating

Will you kindly give us any information you might have on a cleaner and a flux to be used on small brass castings? These are automobile storage battery clamps and are to be lead coated.

Your question suggests that you want a fluxing agent to clean the surface of the castings before they are lead coated. The best way to do this would be to acid dip them in the usual soldering acid. Be sure that they do not come in contact with anything having grease or moisture available to recorrode them before they are dipped in the lead bath.

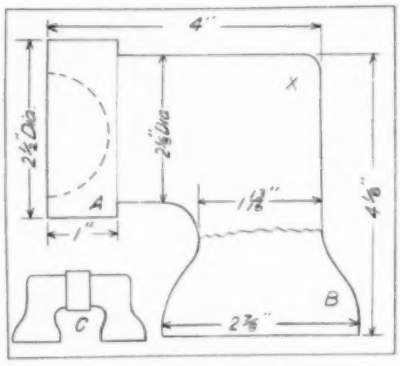
If you are asking for a flux to keep the metal clean while melting, it is hard to answer the question without knowing what alloy is being used, although we presume you are using a yellow brass. If you have aluminum in the yellow brass, you will find it difficult to clean the castings with any acid dip along the lines previously suggested; therefore, aluminum should be kept out.

Yellow brass really does not require a flux to make it clean as much as it does to be properly melted and poured. Of course, it should be well skimmed before pouring.

Core Does Not Stand Up on Core Plate

The core shown on the accompanying sketch cracks at the point indicated and the end marked *A* sags down. The core is made as a unit and the entire weight is carried by the base *B* which rests upon the core plate. The core mixture is made up of 8 parts No. 1 molding sand, 12 parts fine beach sand, 1 pint cereal binder and ½ part oil. When we dig the sand out of the end *A* as shown by the dotted line, the core does not sag or crack. This digging involves extra work and we shall appreciate your suggestion for a good strong core sand mixture that will eliminate this feature.

Increasing the green strength to a point that will enable the core to stand up on the plate without cracking or



Heavy over hanging end A causes the green core to crack at the neck of the vertical part B

sagging may be achieved according to any one of various methods, but unfortunately each method has its advantages and disadvantages. Therefore the final choice will be dictated by local conditions. For example the green strength may be increased by the addition of molding sand or cereal binder. With some cores this would work admirably. In the core under discussion, a further addition of molding sand *might* lower the permeability to a point that would result in scabbed or blown castings. This feature in turn might be offset by replacing the present fine beach sand by a much coarser grade. This point can be determined only by actual experiment.

However, if the present core sand mixture works satisfactorily in the castings, the more logical method of eliminating the trouble would be to manipulate the cores so that they would stand up on the plate. For permanent relief on this and future jobs the core should be made in a double corebox as shown at *C* in the lower left corner of the accompanying illustration. The connecting print in the center may be reduced in length if necessary. The corresponding patterns would be mounted in pairs, right and left on the rollover board or matchplate. An additional advantage of this method is that it eliminates the use of a chaplet at the point marked *X*, a necessity where the present type single core is employed.

Under present conditions instead of scooping sand out of the end of the core to reduce the weight, the same effect might by achieved by cutting, say, ½-inch off the end of the corebox in the event that the box is open at both ends, or, by placing a ½-inch thick half disk in the end of the box if the end is closed. Alternatively a wood or metal plug with a handle might be pressed ½-inch into the open end before the box is removed from the core. Similarly a sprue cutter might be employed to scoop an opening in the end.

Since the removal of a small quantity of sand from the overhanging end is sufficient to prevent the core from cracking or sagging, it seems logical to assume that a piece of ¼-inch rod bent to an angle of 90 degrees and placed in the core would stiffen it sufficiently to stand up when made from the present sand mixture.

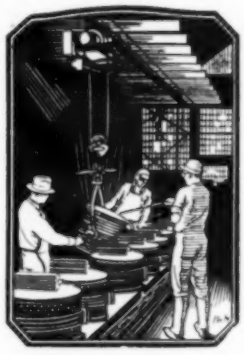
Any one of the three following shop kinks might be employed to prevent the present cores from cracking on account of the excess weight in the overhanging end: 1—Place the cores on plates provided with thin vertical ribs projecting above the face. The end *A* of the core is pushed up against the rib. This added support will prevent it from drooping. 2—Instead of permanent ribs 4 inches high against which the cores could be grouped from both sides, place permanent or removable supports under the part *A*. 3—Place the cores on the plate in pairs facing each other and with the end of the core *A* in one core touching the end *A* of the corresponding core. In this maner each core will support the other.

Long Grids Must Stand 3-Inch Deflection

What mixture would you recommend for a gray iron casting of grid construction 23 inches wide, 7 feet in length, 5/8-inch metal thickness which must be sufficiently flexible and ductile to withstand center loading flat as a beam to a center deflection of 3 inches, and to a permanent bend of ½-inch from straight measured when on edge, followed by reverse loading to an opposite permanent bend of ½-inch without development of flaws.

Any good grade of soft gray iron, say silicon 2.75 per cent, sulphur under 0.10 per cent, phosphorus 0.30 to 0.40 per cent, and manganese 0.50 to 0.60 per cent should make satisfactory castings. However, for extra precaution it may be advisable to use bessemer pig instead of the ordinary grade of foundry pig iron. The addition of 1.25 to 1.50 per cent nickel will improve the flexibility to a considerable extent. We are rather at a loss to understand the specification "A permanent bend of ½-inch from straight measured on edge, followed by reverse loading to an opposite permanent bend of ½-inch." A permanent bend to our mind is a permanent bend. How then can it be imparted to both sides? Also, if a permanent bend is required, why is the casting not made that way in the first place?

Viewing Foundry Developments



At Short Range

IN A large Pennsylvania foundry working three shifts, apprentices are divided between the first and second shifts, one commencing at 7 a.m., and the other at 3.30 p.m. The class room work in connection with the apprentice training course is arranged so that on the days appointed, the boys enter the class room first before they go into the shop. At that time they are fresh and clean and therefore more in harmony with the surroundings. This method also prevents interruption of the working schedule in the shop.

• • •

One thing that might be worth investigating to obtain improved cupola operation, is the claim that sodium carbonate increases the reactivity of coke. Quenching the coke in a strong solution of carbonate should insure thorough impregnation.

• • •

SLOW melting is detrimental in obtaining sound nonferrous castings, and it usually indicates a reducing atmosphere due to a lack of oxygen for proper combustion, according to one authority. With sand castings that condition is indicated by numerous pinholes scattered throughout the metal. Rapid chilling obscures the appearance of the holes.

• • •

In a prominent steel foundry operated as part of a manufacturing plant, ingots for shafts are poured through a small opening in the top of the mold. A timing system has been established for the various sizes so that a maximum time is allowed for filling the mold without the formation of cold shuts. In this manner solidification commences at the bottom and travels gradually and slowly upward. With this method piping practically is eliminated. Metal flows through a 1½-inch nozzle from the bottom of the ladle into a loam or brick lined pouring basin or reservoir set on top of the ingot mold. A small opening in the bottom of the reservoir admits the metal to the mold. While the static pressure drives the metal through the ladle nozzle with considerable force, this force is absorbed by the pool of metal in the reservoir and as a result the metal falls into the mold in a gentle stream.

• • •

BY A recently developed process oxygen is removed from molten iron with a consequently marked improvement in the composition and physical properties of the resulting castings. The iron as tapped from the cupola falls through a perforated refractory disk which breaks the stream into a spray thus permitting the gas to escape. The metal falls into a bath of finishing slag where it is cleaned and blended. The slag is made of broken glass. It is claimed that a typical cupola charge of one third stove plate scrap and two thirds steel scrap which showed a deep chill and a tensile strength of 17,000 pounds in the untreated condition, presented no chill and a tensile strength of 53,000 pounds when subjected to the breaking up process.

• • •

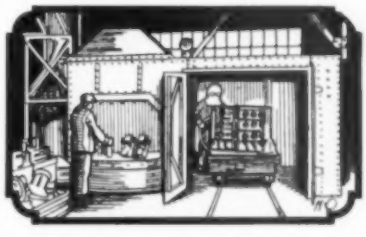
Cast iron for hydraulic cylinders on a grinding machine for finishing cylinder bores on internal combustion engines are being made of the following analysis by the Manufacturers Foundry Co., Waterbury, Conn.: Total carbon 3.20 per cent; silicon, 1.30 per cent; manganese, 0.80 per cent; nickel, 1.50 per cent; chromium, 0.60 per cent. Forty per cent of steel was used in the charge. The castings develop a brinell hardness of 200 and a tensile strength of about 40,000 pounds per square inch.

• • •

NONFERROUS alloys possessing high wear resistance, extreme hardness, resistance to galling, high strength, and high resistance to corrosion at high temperature and pressure, and to dilute acids and alkalies, consist of 1.75 to 2.75 per cent silicon or 2 to 3.25 per cent silicon with the remainder composed of nickel and copper in equal ratios, according to a patent. Tensile strength from 90,000 to 125,000 pounds per square inch, elongation from 2 to 5 per cent, and brinell hardness from 250 to 325 are claimed for the alloys. For machining, the alloys are quenched from 1350 to 1600 degrees Fahr. in air, water or oil. Original hardness is regained by aging at 900 to 1200 degrees Fahr. for 8 hours.

• • •

Control of the metal stream in a recently patented vertical-type, centrifugal molding process is accomplished by use of a conical pouring cup, speed of rotation, and mounting



the pouring ladle off center. That arrangement gives a whirling action to the metal in the pouring cup, distributing it in a circular stream in the mold so that it will strike the mold wall at any desired point. In that way, the metal stream will not impinge on a central core which may be used.

The FOUNDRY Family Photograph Album

Upper Left
PAUL IVY
National Cast Iron Pipe Co.,
Birmingham, Ala.

Upper Right
H. E. McWAYNE JR.
Lynchburg Foundry Co.,
Lynchburg, Va.

Lower Left
F. T. HERRON
Herron Stove & Foundry Co.,
Chattanooga, Tenn.

Lower Right
FRANK J. TONE
Carborundum Co.,
Niagara Falls, N. Y.

Men of Industry

Whose Activities Are Making Foundry History

EDWIN T. DODDRIDGE, senior sales engineer for the molding machine division, the Osborn Mfg. Co., Cleveland, has relinquished direct territorial sales work to become research and development engineer with headquarters at Cleveland.

Mr. Doddridge joined the Osborn organization Aug. 1, 1909, in the early days of the development of molding machines for production foundries, having been head of the pattern department of the Ferro Foundry & Machine Co., and one of that original Ferro foundry group which has made many outstanding contributions to the progress and development of the modern automotive foundries.

Mr. Doddridge's long and successful experience in the field qualifies him for this more important work. By devoting his time and effort in conjunction with management and engineering to meet the more exacting requirements of the modern foundries for molding machines, his field of service to the industry will be broadened greatly. In this new capacity, Mr. Doddridge will continue in active touch with the foundries in carrying on this important function of research and development engineer.

HARRY EWART recently has been made assistant sales manager, Welder division, Harnischfeger Corp., Milwaukee.

JAMES L. WICK, president and general manager, Falcon Bronze Co., Youngstown, O., has been elected chairman of the board of governors of Youngstown college and head of the college executive committee.

WILLIAM H. WALTZ, formerly superintendent, Crucible Steel Casting Co., Cleveland, has been made assistant to the superintendent of foundries, Newport News Shipbuilding & Dry Dock Co., Newport News, Va. Mr. Waltz began his foundry career in 1922 following his graduation from Lehigh university, Bethlehem, Pa., when he entered the employ of the Bethlehem Steel Co., to take the shop course provided by that company. Later in the year he entered the steel foundry as a helper and

Edwin T. Doddridge

utility man. The following year he was promoted to foreman in charge of metal and in 1928 was made assistant superintendent of the steel foundry. During the time he was with Bethlehem Steel Co. Mr. Waltz assisted in the development of foundry practice for alloy steel castings and rolls.

FRANK J. TONE, (see FOUNDRY, album on page 36) president, Carborundum, Co., Niagara Falls, N. Y., has been awarded the Edward Goodrich Acheson medal by the Electrochemical society. This is the second distinguished award to go to Mr. Tone in recent years, he having been the first recipient of the Jacob F. Schoelkopf medal presented by the Western New York section of the American Chemical society. The Acheson award was presented to Mr. Tone for his many important contributions to the development and perfection of practical and commercial processes in the field of electrochemistry, electrometallurgy and electrothermics. He also originated the first commercial process for the production of silicon metal; discovered the electric furnace mullite and spinel, and made important contributions to the commercial development of electric furnace abrasive and super-refractories, particularly silicon carbide, and silicon carbide resistor elements.

Formal presentation of the Acheson award will be made at the Fall meeting of the Electrochemical society, at Washington, Oct. 11.

JOHN O. OSTEGREN, factory manager, Lakey Foundry & Machine Co., Muskegon, Mich., has been made vice president of the company succeeding C. E. Wade, recently resigned.

J. H. EIGE recently was elected president of the Gra-Iron Foundry Corp., Marshalltown, Iowa. T. H. KNUTSON is vice president, and W. B. WOOD, secretary, treasurer and manager.

L. G. SULLIVAN has been elected vice president of the Atlas Steel Casting Co., Buffalo. He will continue in the New York office of that company in charge of the eastern sales.

CHARLES U. GEESEY, Cleveland, has been employed by the Ludlow Valve Mfg. Co., Troy, N. Y., in a consulting capacity to install laboratories, sand conditioning equipment, melting control equipment and other modern improvements for the manufacture of iron, bronze and steel valves.

WILLIAM H. SEAMAN recently resigned as vice president of the Continental Roll & Steel Foundry Co., East Chicago, Ind., to become vice president in charge of roll activities of the Mesta Machine Co., Pittsburgh. Mr. Seaman attended Washington and Jefferson college and Carnegie Institute of Tech-

nology. One of his earliest affiliations was with the Seaman-Sleeth Co., Pittsburgh and later he was with the Pittsburgh Rolls Corp. In 1924 he left the latter company to become vice president in charge of rolls for the Hubbard Steel Foundry Co., East Chicago, Ind.

S. A. Hellings, vice president and general manager, Stewart Die Casting Corp., Chicago, has been elected president of the company, which is a subsidiary of the Stewart-Warner Corp.

W. W. Powell, general sales manager and J. R. Berg, general superintendent, Mesta Machine Co., West Homestead, Pa., have been elected directors of the company.

Nelson W. Pickering recently was elected president of the Farrel-Birmingham Co., Ansonia, Conn. Through a typographical error, it was stated in the March issue that Mr. Pickering was made vice president.

Prof. A. M. Portevin, director of Institut de Soudre Autogene, professor at the Ecole Superieure de Fonderie and the Ecole Centrale des Arts et Manufactures, has been awarded the Bessemer gold medal of the British Iron and Steel institute for 1935.

Armand H. Peycke, recently elected a vice president of American Steel Foundries, Chicago, has been associated with the company since 1912. For a number of years he has been in charge of the spring and brake beam equipment. He will continue as president of the Damascus Brake Beam Co. with headquarters in Chicago.

F. T. Herron, (See Foundry Album on page 36), president and general manager, Herron Stove & Foundry Co., Chattanooga, Tenn., comes from a family which long has had a interest in the foundry industry. His father was one of the originators of the Ross-Meehan Foundry, and a founder of the Herron Pump & Foundry Co. He was a stockholder in the American Brake Shoe & Foundry Co. and was one of the first directors of that company.

Mr. F. T. Herron started his foundry work as an apprentice at the Herron Pump & Foundry Co., and finished his apprenticeship at the Wheelan Machine Co., both of Chattanooga. He then became connected with the American Brake Shoe & Foundry Co., having charge of its cupolas. Later he was promoted to the different foremanships of that plant and then was sent to Mahwah, N. J., where he had charge of the crucible steel department of that organization. Later he returned to Chattanooga to take charge of the cupola plant of the American Brake Shoe & Foundry Co., and remained there until 1917, when he was made superintendent of the Corey, Pa. plant of the American company.

At the outbreak of the war, Mr. Herron joined the army and was stationed at Camp Zachary Taylor as lieutenant in the artillery. After the Armistice, he returned to Chattanooga and took over the foundry operations of the Lucey Mfg. Corp. and 4 years later returned to the American Brake Shoe & Foundry Co. as general manager of their Southern Foundry & Machine plant. After four years, he resigned that position and leased the Southern Foundry & Machine Co. plant to organize the Herron Stove & Foundry Co., of which he was elected president and general manager. Mr. Herron is past president of the Officer's Reserve association and commander of the Davis King Summers post of the American Legion.

W. Worley Kerlin, for a number of years active in the foundry industry, has been appointed metallurgist for the Meehanite Metal Corp., Pittsburgh. His past associations include Packard Motor Car Co., Detroit; Valley Mould & Iron Corp., Sharpsville, Pa.; American Radiator Co., Buffalo; Enterprise Sand Co., Pittsburgh, and Conneaut, O.; Superior Foundry Co., Cleveland; and recently the Michigan Valve & Foundry Co., Detroit. Since 1931 he has devoted considerable time to the technical department of the Gray Iron institute, Cleveland.

C. B. Nolte, formerly president, Robert W. Hunt Co., Chicago, engineers, has been elected president of the Crane Co., Chicago, succeeding John W. Berryman who has been named chairman. Mr. Nolte has been succeeded as president of Robert W. Hunt & Co. by James C. Ogden, recently vice president and identified with the company for more than 35 years. Mr. Nolte has been a director of the Crane Co. and member of the company's executive committee for the past 3 years.

Carlos M. Heath, formerly connected with the metallurgical department of the American Brass Co., Waterbury, Conn., has been appointed assistant metallurgist on the staff of Battelle Memorial institute, Columbus, O. Dr. Charles L. Faust has been made electrochemist on the technical staff of that organization.

The following have been appointed to the technical staff of the institute: C. T. Greenidge, formerly research metallurgist with the A. O. Smith Corp., Milwaukee; Dr. H. R. Nelson, formerly of Cornell university, Ithaca, N. Y.; Dr. Bruce H. Rogers, formerly with the bureau of standards, Washington; Myron R. Nestor, and Phillip C. Rosenthal.

Albert C. Lehman, formerly president, recently was elected chairman of the board of the Blaw-Knox Co., Pittsburgh. Irving F. Lehman, was elected president, and Frank Cordes was made senior vice president. The following officers were re-elected: Chester H. Lehman, vice president; Robert F. McCloskey, vice president; George L. Dumbauld, treasurer; H. B. Loxterman, secretary; B. L. Hirshfield, chairman finance committee; Paul W. Keim, assistant treasurer; H. S. Strassburger, assistant treasurer and assistant secretary; and P. A. McCullough, comptroller.

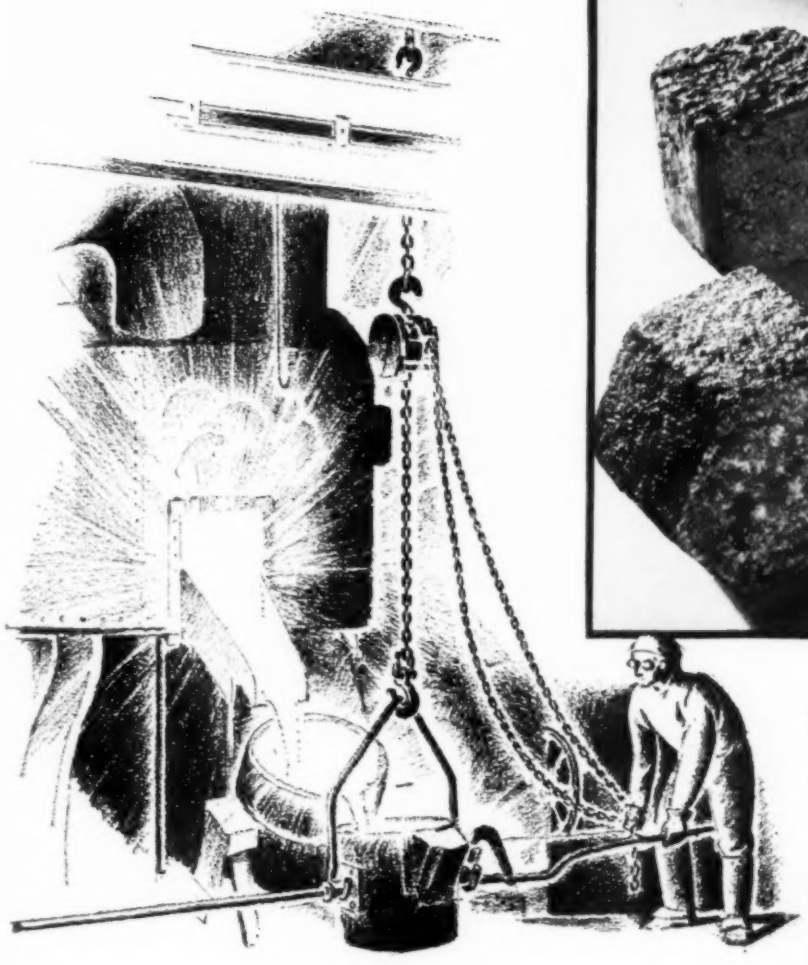
John C. McCallum, president and treasurer of the recently formed McCallum-Hatch Bronze Co., Inc., Buffalo, has been engaged in the nonferrous foundry business for a number of years. During the past 9 years he has been in complete charge of the plant and manufacturing activities of William H. Barr, Inc., predecessor of the McCallum-Hatch Bronze Co. Inc.

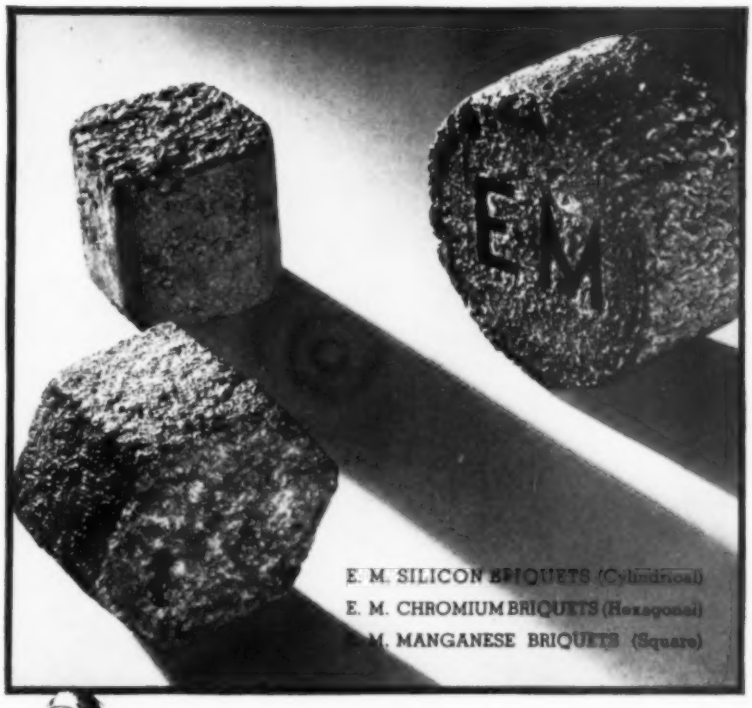
Mr. Hatch was graduated from Gettysburg college in 1917, specializing in chemistry and metallurgy, and before entering the nonferrous field was connected with the Lackawanna Steel Co.

Philadelphia Group Hears Talk on Magnesium

Dr. John A. Gann, chief metallurgist, Dow Chemical Co., Midland, Mich., presented an interesting talk at a meeting of the Philadelphia Foundrymen's association held at the Engineers club, Philadelphia on March 13. Dr. Gann spoke on magnesium alloys and molding practices in connection with those alloys. He discussed properties, structure and corrosion resistance of magnesium alloys and the production of various products from that metal. The meeting was held jointly with the Philadelphia chapter of the A.S.M.

A symposium on the welding of iron and steel will be held in London on May 2 and 3, under the auspices of the British Iron and Steel Institute. The Institute of British Foundrymen will co-operate.





HIGH CHROMIUM CUPOLA IRON

High chromium cast irons are made in the cupola as well as in the electric furnace. These cast irons contain as high as 20 per cent chromium. E. M. Briquets make possible the successful production of the cupola grade of high chromium iron.

E. M. Chromium Briquets for cupola addition insure uniform recovery and complete solution of the chromium. They make possible better control of chemical analysis and physical structure. They can be conveniently handled during charging. Time is saved. Density of grain is increased. Better castings are produced at lower cost.

Electromet Metallurgists will gladly explain how to use E. M. Briquets. A request will bring complete information.

PRODUCTS OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
CARBIDE and CARBON BUILDING
30 EAST 42nd STREET, NEW YORK, N. Y.

Electromet
Ferro-Alloys & Metals
27-M

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Avoids Shrinkage

TO THE EDITORS:

In the March issue of THE FOUNDRY, I note an inquiry relative to shrinkage on aluminum matchplates for gas burners. One method to overcome shrinkage on these plates is to core out the plate mold. Make cores for the burner, venting them as usual. Stop off the vent on the mixer end of core, file a shallow seat on the cope side of the core, one on each side of burner head and one or more on the shank, depending on length of the burner. Then drill through the core until the vent is reached, take some small pieces of round core with a vent hole in them and paste them on the filed seats. They should be long enough to allow for the thickness of wall of the burner and one-half the thickness of the matchplate. Set the core in the matchplate mold using chaplets to secure the core in place. If you prefer you can use the same method on the drag side of the core and eliminate the chaplets. Close the cope and then lift off and vent through the cope over each vent opening. It is well to watch the air mixer end of the core if it fits close, and file down so it will not cut through the sides of the burner print. After the plate is cast, clean out core sand and insert plugs in holes left by core.

JAMES CONKLIN

100 William Street,
Stamford, Conn.

The Patternmaker

TO THE EDITORS:

As an interested subscriber and reader of your helpful magazine, I am taking the liberty of enclosing a recently composed rhyme which I have entitled "The Patternmaker":

Who is he who from blueprint,
Awkward sketch, gestured movement,
Weaves ideas into wood
Which are scarcely understood
By the one whose brain-child 'tis?
The Patternmaker.

Who is he who's most unknown
Save to those poor souls alone
Who would feign eliminate
Work (as though an ugly trait
Of mankind) by strange device?
The Patternmaker.

Who is he who knows by heart
Dreams of those who want a start,
And a pattern's all they need
For their project to succeed,
Rich rewards but to be plucked?
The Patternmaker.

Who is he with furrowed brow
Contemplating, how, Oh how
Can this shape be constructed
And retain, undisrupted,
Friendship with the foundryman?
The Patternmaker.

Who is he who's ill at ease
Telling what his calling is
To uninitiated,
But how soon expatiated
With his fellow craftsmen?
The Patternmaker.

Who is he who uses words
Other people never heard
Or used other than their wont—
Core-box, cope and drag—(but don't
Let us begin talking shop)?
The Patternmaker.

Who is he who'd be content
Were time less an element;
Whose thoughts of paradise
Are blueprints piled to the skies,
Six hours work but pay for eight?
The Patternmaker.

Who is he who plain can see
His great place in industry,
When sadly these words he hears,
While holding check on bitter tears,
"Sorry Bill, that is all for now"?
The Patternmaker.

Who is he whose problems all
To this lay-off seem so small;
Helpless, hopeless fears portend
Resources too near an end,
And prospects most uncertain?
The Patternmaker.

JAMES MCEWAN

Reliable Pattern Works
San Jose, Calif.

Detroit Meeting Features Steel Castings

Frederick A. Melmouth, Detroit Steel Castings Co., Detroit, presented an interesting talk on "Steel Castings" before the members of the Detroit Foundrymen's association at a meeting held in the Savoyard club, Detroit, March 21. Mr. Melmouth discussed the history and development of the steel castings industry and described the various practices employed in the steel foundry in the production of castings.

Dan M. Avey, editor THE FOUNDRY, and president of the American Foundrymen's association, spoke briefly on the importance and value of the distribution of technical knowledge through group activity. Robert E. Kennedy, technical secretary, American Foundrymen's association, Chicago, reviewed the tentative program for the foundry short course to be held at Michigan State college in May, and also discussed the annual convention of the A.F.A. which will be staged in Toronto in August.

The February meeting of the association, was addressed by Rex Jennings, Ecorse Foundry Co., on the subject "Use of Alloys in Cast Iron."

Discusses Green Sand in Steel Practice

Attendance of almost 100 marked the March meeting of the Pittsburgh Foundrymen's association held at the Fort Pitt hotel, Pittsburgh, March 18. Following dinner the speaker of the evening, D. D. Cameron, general superintendent of Pratt & Letchworth Co., Buffalo, was introduced. His paper on "Sand Control and Pin Holes in Steel Castings" was read by William F. Rose, also of the Pratt & Letchworth Co. The address was well illustrated with numerous lantern slides, and in addition, a short motion picture on "Making and Casting of an Alloy Roll Heat" was shown. This motion picture was taken at the Pratt & Letchworth Co. plant.

Mr. Cameron stressed the importance of properly prepared green sand for the manufacture of steel castings. The steel foundry practice of the Pratt & Letchworth Co. is consistent in its use of green sand. By extremely hard ramming when molded, green sand castings, according to Mr. Cameron's paper, bring out trueness to pattern, weight and close size tolerances which are necessary in such intricate work as automobile differential housings. Other slides showed accurate casting exhibits on such equipment as grab buckets, gears, hubs, wood pulp shredders, rudders and plate glass rolls.

Following the address, Martin Baker, Pittsburgh Steel Foundry Corp., Glassport, Pa., led a discussion centering on green sand foundry problems.

C. H. Paul, secretary of the Pittsburgh Foundrymen's association, announced that the association's next gathering will be at Carnegie Institute of Technology, Pittsburgh, April 15. Professor Leeds of Carnegie Institute of Technology will address the meeting, and A. M. Ondreyco, vice president of the Pittsburgh Foundrymen's association, will lead the discussion. Dinner will be served at the Tech Inn. The May meeting of the association will be devoted to a nonferrous subject, and in June the association tentatively is scheduling its annual outing.

At the March meeting, W. J. Garrison won an attractive fountain pen as a door prize.

"I'd like to have a Dollar for every PANGBORN name plate I've handled!"

★ ★ ★

AND NO WONDER!

IN Pangborn's files are the names of over 5,500 owners of Pangborn Blast Cleaning and Dust Collecting equipment.

•

Over a thousand of these accounts, representing the country's leading industrial concerns, have owned Pangborn equipment continuously for 21 years or longer!

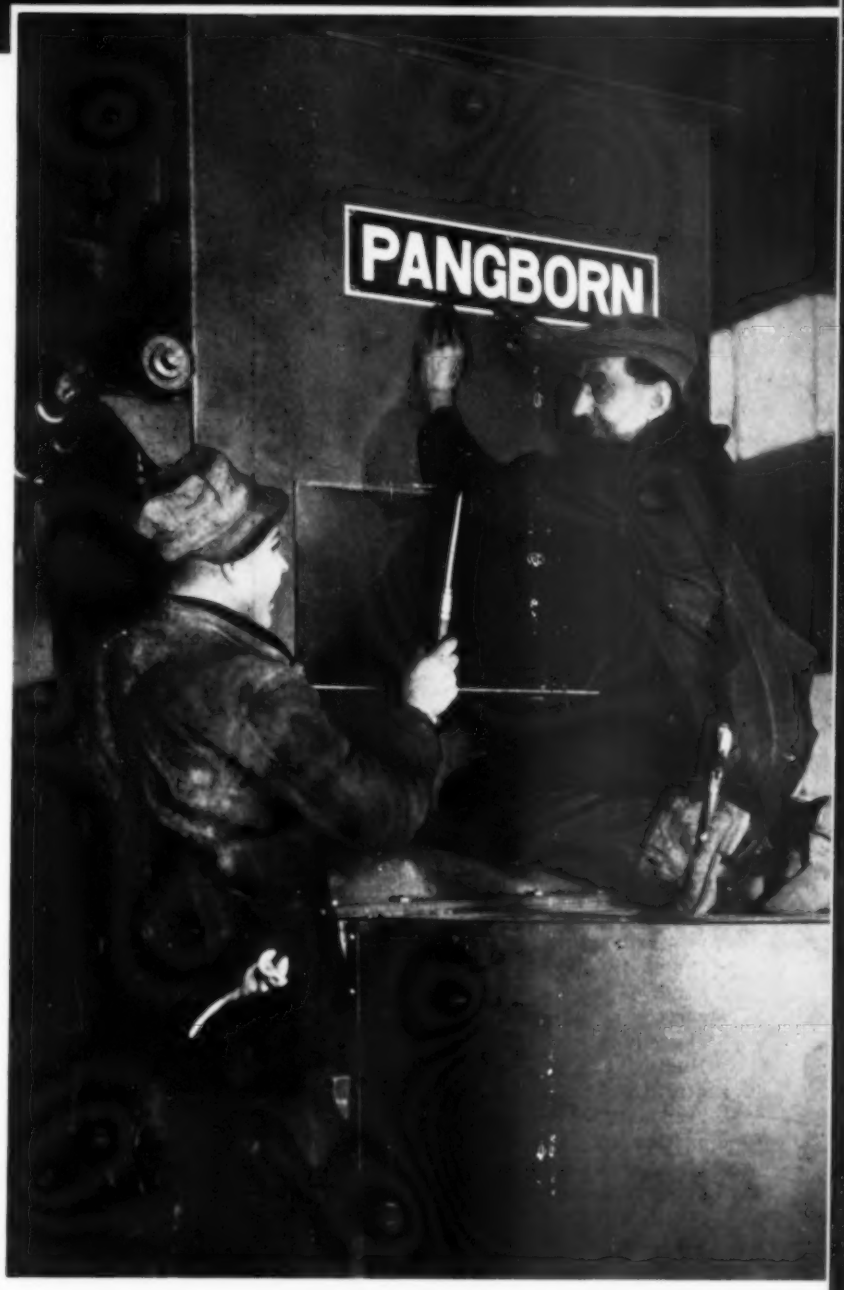
•

The great majority of Pangborn equipment owners have five to ten different units . . . many have twenty. Ten nationally-known manufacturers have a combined total of 1,065 Pangborn Blast Cleaning and Dust Collecting units. One famous electrical concern has 307 Pangborn installations!

•

Such confidence . . . the greatest tribute, we believe, ever paid to a manufacturer of Blast Cleaning or Dust Collecting Equipment . . . has been gained only by outstanding leadership in design and performance. It is proof that Pangborn equipment is soundly engineered, sturdily built, honestly priced, and then sold with a four-square guarantee written for and faithfully protecting . . . EVERY BUYER!

★ ★ ★



We specialize exclusively in BLAST CLEANING and DUST COLLECTING EQUIPMENT and SUPPLIES

Write for free Bulletins describing Centrifugal Blast Machines; Blast Cleaning Rooms, Barrels, Tables, Cabinets; Steel Abrasives; Nozzles; Hose; Helmets, Hoods and Respirators; Dust Collectors and Exhausters; etc.

PANGBORN

The World's Largest Manufacturers of Blast Cleaning and Dust Collecting Equipment

HAGERSTOWN . . . . . MARYLAND

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

THE flat disk shown in Fig. 269 is typical of certain malleable castings which become distorted during the annealing period. This does not refer to castings that are improperly packed, or to castings which droop under their own weight, or because the weight of castings above press on unsupported areas. The casting shown in Fig. 269 may be perfectly round when it leaves the sand in the hard iron stage. A large number of castings may be loaded flat in the annealing pots or on the car, and yet when they have cooled they are found to be out of round.

Gates Set Up Resistance

Almost without exception that form of distortion may be traced to gates. With the view of distributing the metal uniformly the molder places the sprue in the center with two gates entering the mold opposite each other on a diametrical line. Casting and gates contract in a fairly uniform manner with the result that the casting is round as it leaves the sand. However, the gates set up a certain amount of resistance with a consequent strain in the casting. During the annealing process that strain is relieved and the casting readjusts itself and the result is a casting no longer truly round. No blanket rule can be laid down on the proper number of gates and their position. The decision is based on experience and judgement. What may be suitable for one casting may cause trouble in another of almost identical shape and size. A close examination of the annealed casting will be required to determine whether the distortion is due to contraction or expansion. The ideal way to gate a round casting is to place a series of gates about an inch apart around the circumference, but generally that method is impractical either on account of the flask size or the distance the metal has to travel in the event it must be poured from a single ladle. The amount of metal remaining in a gate of that kind also is an item.

The casting might be gated on the outside through three gates spaced approximately equal distances apart and each fed from a single sprue, if three ladles are available. The exact position of each gate must be determined by experiment. One might be placed at the heavy section on the left, a second opposite the boss on the right and a third about midway between these.

In some instances the only practical method to secure perfectly round castings is to make the pattern slightly oval, with the bulge at the section which pulls in. When the casting contracts, it pulls in the bulge and corrects the excess contraction. If the casting must be gated in the center, the two branches shown in Fig. 269 will offer less resistance to contraction, and consequently set up less distortion strains, than if the two gates are placed on a diametric line.

The pattern, chill and gate shown in Fig. 270 are typical of the manner in which the foundryman in many instances is forced to compromise between what he wants and what he has to accept. The pattern originally was designed for a gray iron casting. The flask was a snug fit and was cut at the ends to fit over the core prints. Later the customer decided to have the castings in malleable iron, made in the same foundry. Naturally the foundryman with the pattern equipment and large number of flasks on hand was forced to take hobson's choice.

Chill the Flanges

A strainer core was placed at the bottom of the sprue and the runner was thickened by placing half in the drag and half in the cope. The first malleable castings developed a shrinkage defect on the cope side at the junction of the flange with the body. This was overcome by placing a chill against each flange, as shown at *C*. Four spikes, slightly bent, anchored these chills in place. The spikes were cast in the chills as shown in the sectional view taken on the line *AB*.

Possibly a large feeder on top of each flange would have answered the same purpose, but that would have meant a much deeper cope and the melting of an additional quantity of iron. Had the flask been longer, a heavy feeding gate at each end might have been employed. These gates would fill the mold with hot iron of uniform temperature and the tendency to shrink would have been distributed in a more normal manner.

The groove in a small sheave wheel may be formed either in green sand or with a dry sand ring core. Each method has advantages and disadvantages and the relative merits of the two only may be determined by a careful anaylsis of all the factors including the size of present and prospective orders, patterns on hand or to be made, and available molding equipment. One method for arranging patterns and gates on small malleable iron sheaves made in green sand in a snap flask is shown in Fig. 271.

In the larger sizes the patterns are

(*Continued on page* 44)

Use Chill Molds

THIS installment is the sixty second and concluding number of a series of articles presented in THE FOUNDRY over the past four years, dealing with the general subject of gates and risers, names, shape, position, application and the important niche they occupy among the many factors involved in the production of castings. For convenience in presentation and future reference, the series was divided into four main sections dealing respectively with gray iron, nonferrous metals, steel and malleable iron. Final reference in the present section is to gating methods employed in the latest foundry development, the production of malleable iron pipe fittings in iron molds. The technique differs to a considerable extent from that practiced where the molds are made in sand.

His Boss COULDN'T BELIEVE IT

★

. . . when he showed him how little the nozzle had worn after 1500 hours' use

★

THIS pleasant surprise has happened not only to one boss—but to many. The new PANGBORN-NORBIDE* Long-Wear Blast Nozzle is today's sensation in hundreds of progressive blast cleaning rooms.

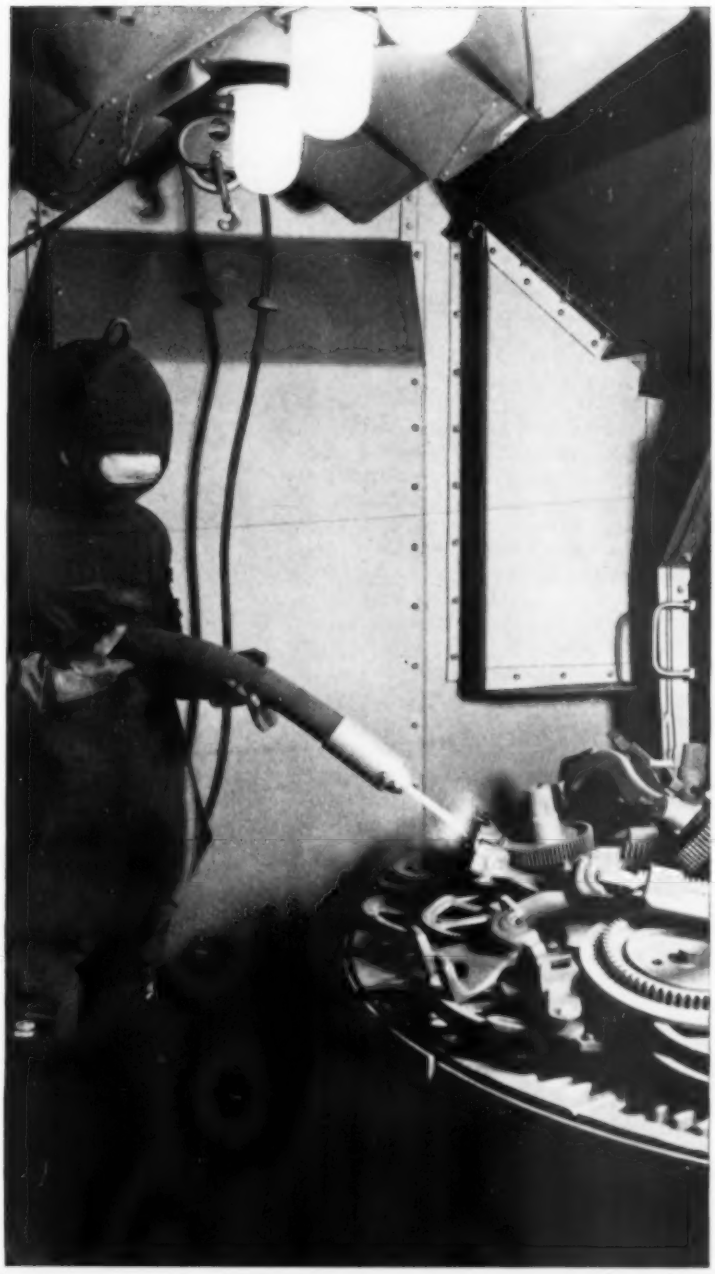
To date, 843 PANGBORN-NORBIDE* Nozzles are in use. *None has yet worn out!*

A large corporation, manufacturing a famous low priced automobile, tried several . . . soon ordered more . . . and today has 108 PANGBORN-NORBIDE* Nozzles in operation on their blast cleaning equipment!

If you are interested in dollar-value and want an economical way to reduce your blast cleaning costs . . . *here's your answer!*

ORDER A
PANGBORN-NORBIDE*
LONG-WEAR
BLAST NOZZLE
NOW

*Trade mark of Norton Company for Boron Carbide.



The Pangborn Corporation specializes exclusively in Blast Cleaning and Dust Collecting Equipment—including everything for use with these processes.
Low prices—prompt delivery.

PANGBORN

The World's Largest Manufacturers of Blast Cleaning and Dust Collecting Equipment

HAGERSTOWN . . . . MARYLAND

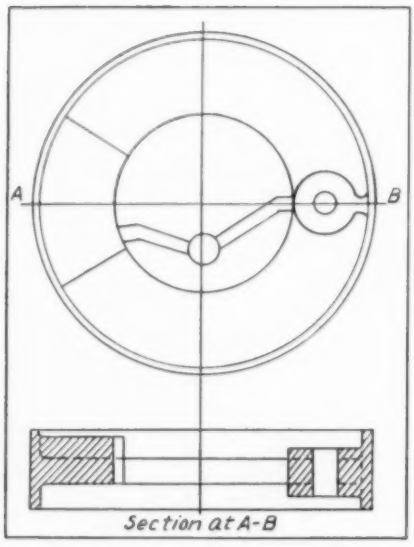


Fig. 269—The gate is staggered to facilitate contraction of the casting

(*Continued from page* 42)

mounted singly on plaster follow boards, but in the smaller sizes several patterns are grouped to utilize as much space as possible in the flask. For short orders, wood patterns serve satisfactorily, but where a considerable number of castings are required the patterns usually are made of brass or white metal. These metals are easily finished. Also, in the event that the gates are not cast in position, they readily may be attached by soldering. The wheel patterns are turned and finished in the lathe, parted in the center of the rim and fitted by a male and female joint. This type of joint is preferable to a flat joint and dowel pins. The half pattern designed to be molded in the drag carries the arms and hub, or the entire web in the event that the sheave is of that type. The second half of the pattern is a plain ring which forms one half of the groove.

Roll Mold Twice

To make a mold with this rigging the flask has to be turned over twice instead of the usual single roll on the drag. The plaster follow board is dished to bring the upper face of the patterns flush with the rim of the follow board. The four sheave patterns with gates attached are adjusted in place on the board. Riddled sand is tucked into the grooves with the fingers and then the remainder of the space around the patterns is filled with sand, which is rammed to the required density. The superfluous sand is scraped off flush with the upper rims of the patterns and the corresponding edges of the follow board. The surface is brushed clean with a light coating of any of the various parting materials.

The *cope* half of the snap flask then is put on, rammed full of sand and both flask and follow board are rolled over. The follow board is removed, parting material sprinkled on the upturned face of the mold, after which the *drag* half of the flask is set in place, rammed full of sand and lifted off. The four principal parts of the patterns connected by the gate members are removed as a unit, after which the drag is replaced and both halves of the mold are rolled over. The cope, now in its proper relative position, is lifted off and then the rings, or second parts of the patterns, are removed. The hub core is set, the mold is closed and the snap flask is removed in the usual manner. In foundry parlance, the process is known as making a 3-part job in a 2-part flask. The core forming the groove is not removed at any stage of the process. In the first rollover it is supported by the entire pattern. In the second rollover it is supported by one half of the pattern and thus is prevented from shifting.

Flanges and other castings for high pressure pipe lines must be leak proof. It is essential that the metal in all sections shall be free from all forms of shrinkage defects, cracks, draws, porosity, sponginess or segregation. At one prominent plant engaged in the production of that line of castings, particular attention is given to adaptation of gating systems to bring about the desirable result. The patterns are mounted on matchplates with gates and risers in place. That arrangement not only facilitates the molding operation and insures perfectly clean passages for the metal, but eliminates one of the variable factors, when the size, shape and position of gates and risers are left to the discretion of the individual operator. Typical application of the system to a large flange is shown in Fig. 272.

The system is based on the theory that the hottest metal is required in the riser which feeds the casting, that a large amount of metal is needed in the riser, and that this riser should be in position to heat the sand in the vicinity. The object has been accomplished by introducing the metal into the bottom of the riser and then allowing the metal to flow from the riser through a large feeding gate into the mold cavity.

It will be noted that this is in direct opposition to the usual method where the metal from the gate enters the mold cavity, then flows into the feeder channel and thence into the riser. As a result, the metal in the riser, particularly at the top, is lower in temperature than in any other part of the casting and therefore is not so effective in the anticipated function of feeding the casting.

In this connection it is interesting to note that this method frequently was advocated by the late Charles Vickers for certain classes of nonferrous castings. The basic feature, that is flowing the metal through the riser into the casting and thus securing maximum temperature in the sand around the feeder, was referred to by George Batty in a paper dealing with gates and risers on steel castings presented at the 1934 Philadelphia convention of the American Foundrymen's association.

In the casting illustrated in Fig. 272 the metal is poured from opposite sides of the mold through two sprues and the large casting is fed by two risers. On smaller castings one gate and one riser are sufficient. In like manner several modifications are practiced in the design and position of the sprue. In some instances the sprue is placed directly above the large end of the horn gate with a strainer core at the junction. In addition to functioning as a strainer, the core also retards to some extent the velocity of the descending stream of metal.

An Alternative Gate

In an alternative method, a short horizontal runner at the joint conducts the metal from the sprue to the horn gate. Again, the sprue passage may extend a short distance into the drag to form a well where the falling metal is cushioned before it starts to flow through the horizontal runner into the horn gate. On the smaller size flanges and other castings of a somewhat similar character where the riser occupies the greater part of the space in the center, a dry sand ring core is placed in the pattern and rammed up with the cope.

A slight variation of this method is employed in the production of small generator motor frame castings where the entire casting is below

(*Concluded on page* 47)

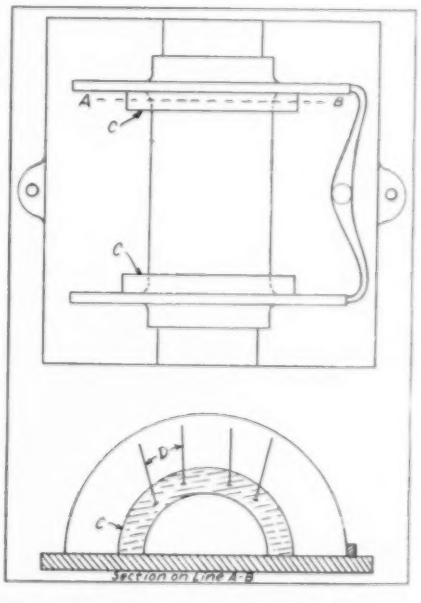


Fig. 270—Plan and sectional view of flanged casting pattern with chills in place

ADVERTISING PAGES REMOVED

(*Concluded from page* 44)

the joint line between cope and drag. The molds are made on a jolt ram machine with two castings in each mold. The patterns are in opposite corners to provide room for the horn gates. The metal is poured through a central sprue connected to a runner in the cope, which in turn leads to each of the horn gates. Instead of a riser extending through the cope, a shorter riser or shrink bob is attached to the upper rim of each casting at a point opposite the entrance of the horn gate at the bottom.

A point occasionally overlooked in the application of chills, is that—in some instances—they are not sufficient in themselves to cure shrinkage. They may prevent a shrinkage defect at a definite point, but unless the casting is fed in an adequate manner, the shrinkage will show up elsewhere. A shrinkage cavity in another location may or may not be sufficient to condemn the casting. Obviously this feature only may be appraised properly by a consideration of the purpose for which any given casting is intended.

Shift the Shrink

H. A. Schwartz in *American Malleable Cast Iron*, states: "By accelerating freezing they (chills) suppress the shrink in their immediate vicinity. However, since the reduction in volume still exists, an equal volume of shrinkage will develop elsewhere. Continuously supplying molten iron until the entire casting is frozen is the only actual preventive of shrinks. The shrink always is found in the slowest freezing locality. Therefore if a feeder of still slower cooling rate, attached to the casting, is located so that the metal can flow from it to the location in which the shrink is found, then the shrink will be transferred to the feeder and be of no consequence, since the feeder, riser or shrink bob, is not a part of the finished casting."

In a comprehensive paper prepared by Harvey W. Hyde a few years ago on the methods and equipment employed in the production of malleable iron pipe fittings in chill molds he states that a great deal of experimental work was required in developing a proper gating technique. In all, some 50 methods were tried in this experiment.

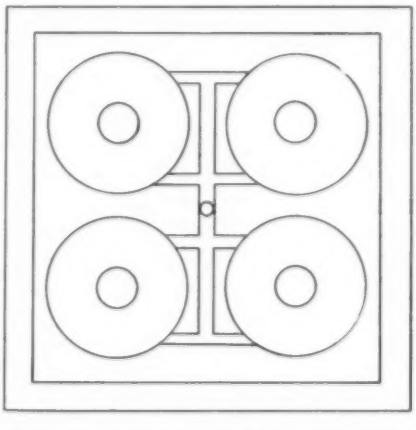


Fig. 271—Gating system on small sheave wheels

More care must be exercised in gating chill molds than is necessary with sand. The metal must enter the mold as quietly and rapidly as possible and it must be skimmed thoroughly. This skimming is important because of the low temperature of pouring. Feeders are necessary and should be placed as close to the gate as possible. They should be of ample size to prevent sponginess around the gate. The metal must enter the mold without agitation or splashing of any kind.

Considerable success has resulted from the use of a flowoff at the top of the mold. This allows the chilling action of the mold to progress while a small amount of metal still is passing through the casting. As the metal rises in the flowoff, the rate of pouring is reduced until the casting freezes in the mold, thus shutting off the flow of metal. This action of progressive freezing serves as an excellent feeder and little trouble is found with shrinkage in the castings poured by this method.

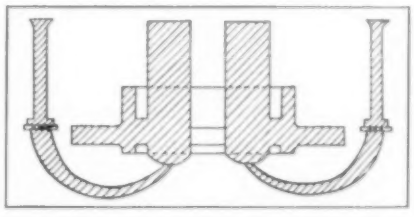


Fig. 272—Sectional view of horn gates and large feeders on pressure flange

The ideal gate for chill mold work is one through which the metal enters the mold at the bottom through an external core held in the mold outside the main core. It should be arranged as shown in Fig. 273 so that a small basin receives the first metal and traps it so that no shot passes into the mold proper. That trap also will act as an effective skimmer. The gate should be large enough to take the metal rapidly, but quietly.

Pouring from the bottom will protect the mold as the freezing metal will form a channel for the remainder of the iron to pass through and only quiet, cool metal will come in contact with the mold face. With a flowoff at the top of the mold, a gate of that kind will feed the casting amply if placed at an angle of 180 degrees from the flowoff. If the two are placed in direct line, there may be a small shrinkage under the flowoff. Application of that gate will require some experimental work to locate it in the correct position for any given casting.

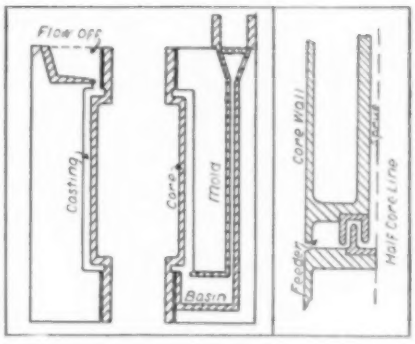


Fig. 273 (Left)—Usual type of gate and flowoff on permanent mold. Fig. 274 (Right)— A baffle core at the bottom retards force of stream

A gate of that type requires a more expensive and complicated mold than a mold in which the gate is formed in the body core. This second type of gate must answer the same purpose outlined and necessarily the core will be more complicated and expensive. In addition the action of a gate in the core is more severe on the mold through erosion and impingement of the metal at the point of entry. Best type of gate to adopt depends on the character of any given casting. Usually this is a feature which cannot be determined offhand.

Gated at the Top

Metal entering the mold through a core at the bottom of the casting tends to cause shot in spite of all the care taken to prevent it. If the point of entry is in a thin section of the casting, erosion is hard on the mold and local heating will be severe. If the entry is in a heavy section, there will be some difficulty in feeding the gate sufficiently to prevent a spongy area. Placing the gate at the top of the casting in such a position that the direction of the entering metal is changed abruptly as shown in Fig. 274, will reduce splashing to a minimum and the point of entry can be at a thin section that will assist in the proper freezing of the metal in the gate.

A gate in that position should be wide and thin so that the metal will fall in the mold in a wide, flat stream which extends the area of impingement and reduces the ill effects of this action. Metal should not enter the mold at a spot where it strikes any lettering or sharp corners. These are the weakest points in the mold face and most susceptible to cracking and erosion.

This is the sixty-second and concluding article in a series dealing with the various types and applications of gates and risers used in the foundry industry.

THE EDITORS.

Gray Cast Iron—*Chapter I*

(Continued from page 21)

phosphorus in solid solution is so small that positive proof of its presence or absence has not been established by present analytical methods. As a general rule the presence of an element in solid solution in a pure metal increases the strength and hardness. Other properties such as grain size, corrosion resistance, electrical conductivity, etc., also usually are modified. Thus the presence of considerable silicon in the ferrite of gray iron increases the strength and hardness of that component.

Jeffries and Archer have calculated that the ferrite of a gray iron containing 2.00 per cent silicon in solid solution would have the following approximate physical properties:

Tensile strength, pounds per square inch..... 85,000
Elastic limit, pounds per square inch 40,000
Elongation in 2 inches..... .....43 per cent
Reduction of area.....66 per cent
Brinell hardness..... 130

It is interesting to compare these figures to the values given for pure iron in a preceding paragraph. British metallurgists, in their tests of completely annealed irons of nearly 100 per cent ferritic matrix found that strength and hardness increased somewhat with increase in silicon, other factors being equal.

The author rarely has found irons under 120 or 130 brinell even if of ferritic matrix.

Alpha iron, or ferrite, in pure iron alloys is the stable form at room temperature. However, it is well known that iron can exist in several allotropic modifications, dependent on temperature and presence of certain alloying elements.

Sulphur in Two States

According to Sauveur "Allotropy implies marked and sudden reversible changes taking place in some of the properties of a substance at certain critical temperatures, excluding formation or dissociation of chemical compounds and changes of state —Many substances undergo allotropic changes.—Sulphur (for example) exists under two distinct conditions, namely as prismatic sulphur and as octahedral sulphur. The prismatic form being the one stable above 95.6 degrees Cent. and, likewise, on cooling, prismatic sulphur begins to pass to the octahedral form at that temperature. Many of the physical properties of sulphur (crystalline form, specific heat, heat of combustion, etc.) undergo sudden changes as the substance passes from one allotropic form to another."

Iron, if we accept Professor Sauveur's definition of allotropy, can exist in four allotropic modifications. These are known as alpha iron or ferrite, beta iron, gamma iron and delta iron. Evidence obtained from X-ray crystal analysis shows a difference in atomic arrangement between alpha and gamma iron while alpha, beta and delta iron are identical in the atomic structure of their crystals.

Pure iron melts at 2786 degrees Fahr. (1530 degrees Cent.). From that temperature down to 2550 degrees Fahr., iron exists in a body centered form (unit cell indices 2.93

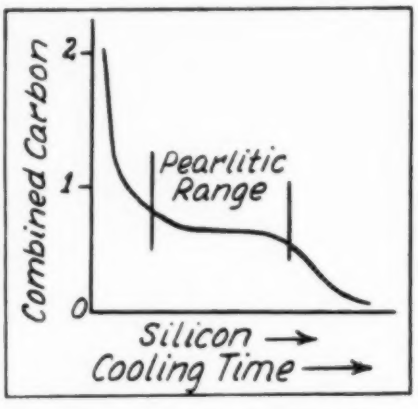


Fig. 21—Pearlitic range in cast irons, according to Everset

Angstrom units, density 7.33 at 2600 degrees Fahr.). It is magnetic. Pure iron in the temperature range of 2550 degrees Fahr. to the melting point is known as delta iron.

Below 2550 degrees Fahr. down to 1650 degrees Fahr., pure iron exists in the gamma form. Both the upper and lower critical points are manifested by thermal arrests, that at 1650 degrees Fahr. being marked. The gamma formation possesses many distinctive characteristics. The space lattice is face centered. The indices of the unit cell are 3.63 Angstrom units and the density is 7.70 at 2000 degrees Fahr. as shown in Fig. 19, according to Hull. Gamma iron is nonmagnetic. It can hold considerable percentages of carbon in solid solution; from about 0.85 per cent at its lowest temperature of existence up to 1.7 per cent or thereabouts at the eutectic temperature. The solution of carbon in gamma iron is known as austenite.

Below 1650 degrees Fahr. iron exists in the body centered cubic formation. At 1415 degrees Fahr. there is another thermal arrest. There are certain changes in thermal and electrical conductivity, and magnetism is not fully restored. Some hold that iron between 1415 and 1650 degrees Fahr. exists in what is termed the beta modification, following the definition of allotropy by Professor Sauveur previously given. Others do not agree that beta iron, because its crystal structure is identical to that of alpha iron or ferrite, is a true allotropic modification. Below 1415 degrees Fahr. there is no further change in space lattice and magnetism is fully regained.

Those interested in ordinary foundry metallurgy need vouchsafe little attention to the beta and delta modifications of iron. For practical purposes it is sufficient to remember that alpha iron or ferrite is stable at room temperatures, and, in pure iron, there is a transformation of alpha to gamma at 1650 degrees Fahr. At room temperatures alpha iron or ferrite is capable of holding only slight amounts of carbon in solid solution. As the temperature is increased the amount soluble is increased slightly, probably not exceeding about 0.03 per cent carbon just below the lower transformation point. Alpha iron or ferrite is magnetic.

On the other hand gamma iron can hold considerable percentages of carbon in solid solution; from about 0.85 per cent at just above the lower transformation point, up to 1.7 per cent or thereabouts at 2100 degrees Fahr. Solid solutions of carbon in gamma iron are known as austenite.

Gamma Changes to Alpha

The transformation point occurring at 1650 degrees Fahr. in pure iron is lowered with increasing carbon content, and by the presence of certain other elements, for example, nickel. In ordinary gray iron the gamma iron containing dissolved carbon changes to alpha iron (which may occur as free ferrite and also as one of the constituents of pearlite as will be explained later) at about 1325 to 1350 degrees Fahr. depending on the composition of the iron and on other factors.

Ferrite generally is associated with the graphite flakes in ordinary irons containing pearlite, graphite, ferrite and steadite. When the iron is rather coarse grained, Fig. 1, the ferrite usually parallels the large flakes. When the fine graphite structure referred to as the graphite pseudo-eutectic occurs, that structure often is embedded in ferrite as shown in Fig. 2. A higher magnification micrograph, a close up view so to speak, is shown in Fig. 3.

As a general rule the individual ferrite grains are smaller in quickly cooled samples and larger in more slowly cooled sections. In a given sample wide variations in size of individual ferrite grains is not unusual.

Gray irons containing large amounts of ferrite (other factors being equal) are comparatively soft, weak and readily machinable. Al-

(Continued on page 50)

TRAUGHBER "Froth-Flotation" AIR FILTER HAS PROVEN ITS EFFICIENCY IN ACTUAL OPERATION

● Five months ago The Traughber Froth-Flotation Air Filter was a principle—accredited by some of being the hit of last November's Foundry Show. Today, with their efficiency demonstrated in the Chevrolet Grey Iron Foundry at Saginaw, these machines take their place with other Bartlett-Snow equipment . . . a proven device that promotes cleaner, better and more efficient foundry operation.

Proven Record

Designed and installed by Bartlett-Snow engineers, this installation draws hot dust-laden air from a tunnel 200 feet long—handles about double its rated capacity, with high recovery. The Traughber performs a service in which other equipment using other methods of recovery had failed. It operates 20 hours a day—requires infrequent inspection.

New Design

In a Traughber, the air is drawn to the distributing chamber, then carried upward through bubble caps and passed through a water blanket and frothing filter carpet before being discharged. The unit requires little floor space—can be mounted from the roof—or placed entirely without the building. It will experience little wear—cannot catch fire. More complete details with recommendations as to the size best suited for your plant are available on request. Write for descriptive folder.

TRAUGHBER "Froth-Flotation" AIR FILTER

THE C. O. BARTLETT & SNOW CO., 6201 Harvard Avenue, Cleveland, Ohio
In New York: 30 Church Street ● *In Chicago:* First National Bank Building

BARTLETT-SNOW *foundry Equipment*

SHAKEOUTS — SCREENS — ELEVATORS — CONVEYORS — HOPPERS — MIXERS — AIR FILTERS
PARTIAL AND COMPLETE SAND PREPARATION AND SAND DISTRIBUTING SYSTEMS

(*Continued from page* 48)

though ferrite is relatively ductile the presence of graphite flakes does not permit the ferrite's ductility to become evident, and ordinary ferritic gray irons show little more real ductility than irons of nonferritic matrix. However, in malleable iron the graphite is present in nodular rather than in flake form, and considerable ductility is attained.

Cementite is iron carbide whose chemical formula is Fe_3C. It is not found in the *free* or *massive* form in truly gray irons. However, ferrite and cementite are associated in the eutectoid pearlite. This composite component pearlite forms an important portion of the structure of most gray irons, and its makeup will be more fully described later. Free cementite is found in chilled irons and in mottled irons. The general appearance of free cementite in a chilled iron is shown in Fig. 12. Cementite shows up white when nital or picric acid are used as etching reagents. However, it is blackened rapidly when etched with alkaline sodium picrate; the appearance therefore being the negative of a picric acid sketch.

Cementite Is Hard

As indicated by the formula, Fe_3C, cementite (iron carbide) consists of three atoms of iron and one of carbon. It contains 6.67 per cent carbon by weight, the remainder 93.33 per cent being iron. Westgren and Phragmen — *Journal Iron and Steel Institute*, 1922 — showed that the unit crystal lattice is an orthorhombic parallelopiped of large size (4 Fe_3C) having lattice dimensions of 4.518, 5.069 and 6.736 Angstrom units, Fig. 20. Cementite is an extremely hard and brittle substance.

The mechanical properties of cementite, according to Sauveur are:

Tensile, pounds per square inch	5,000
Elongation	negligible
Brinell	above 600

(6.5 Moh's scale of Hardness)

The figure for tensile strength possibly is low, and may be explained by the difficulty of getting a true tensile test on so brittle a material. The crushing strength of cementite is high.

As mentioned previously, cementite occurs in the pearlite in gray irons and free cementite is found only in chilled or mottled irons. The distribution of cementite in white irons depends upon the position of the alloy in the iron carbon diagram.

Cementite is a metastable compound and under certain conditions may be broken down readily into its components, iron and carbon (iron and graphite). Above the eutectoid temperature austenite and graphite are formed; under suitable conditions, on cooling below the eutectoid temperature, ferrite and graphite may be the sole constituents. The presence of silicon promotes and accelerates that reaction.

A portion of the manganese in gray iron occurs with the combined carbon as manganese carbide (Mn_3C). Since the atomic weights of manganese and iron are nearly the same, manganese carbide contains about the same percentage of carbon as iron carbide (6.67 per cent). X-ray studies of manganiferous cementites by Westgren and Phragmen and later by Shimura indicate that the space lattices apparently closely resemble those of iron carbide.

Carbide of iron and carbide of manganese are not distinguishable by usual microscopic methods and probably are intimately associated in the cementite structure.

Cementite also may contain small amounts of dissolved silicon and sulphur, possibly as iron silicide and iron sulphide respectively.

The bulk or larger portion of the matrix of most commercial irons is composed of pearlite. That component shows up gray in low power micrographs of iron which has been etched with alcoholic picric acid or with nital as in Fig. 14. Such an etched sample sometimes exhibits an iridescent sheen when viewed by oblique light. The similarity of that appearance to the rainbow coloring of mother of pearl led Howe to name the component *pearlite*. In gray irons practically all the combined carbon is contained in the pearlite. Higher magnification reveals that pearlite is a composite structure, built up of two components arranged in alternate lamellae, Fig. 15. These components are ferrite and cementite. (Ferrite and cementite associated in this intimate manner must not be confused with free ferrite and free cementite discussed in preceding paragraphs.) The smaller or narrower lamellae are composed of cementite. This can be shown by sodium picrate etching, which darkens the cementite lamellae. Pearlite, composed of alternate lamellae of ferrite and cementite, is arranged in grains, as is evident from the directions of the lamellae in Fig. 15. While the laminated structure is the usual form of pearlite, it sometimes occurs in different arrangements, as will be explained later.

Pearlite From Austenite

Pearlite is what is known as an eutectoid structure. The term eutectoid indicates an intimate mixture, resembling an eutectic in this respect, which is precipitated at a definite and constant temperature—the transformation point—from solid solution. Pearlite in gray iron is formed from the solid solution austenite, as the temperature drops below about 1350 degrees Fahr. In *pure* alloys, eutectoids are of constant composition. The transformation from solid solu-

(*Concluded on page* 53)

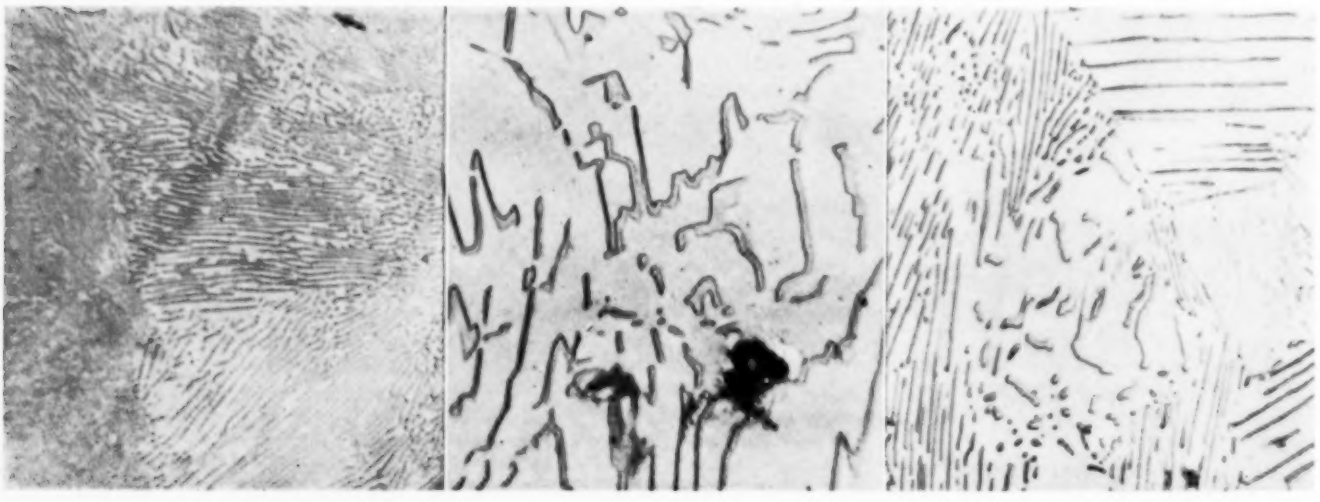


Fig. 22 (Left)—Finely laminated pearlite, x2000, etched. Fig. 23 (Center)—Acicular appearance of pearlite, x2000, etched. Fig. 24 (Right)—Grains largely ferritic with a few cementite lamellae, x2000, etched

ADVERTISING PAGES REMOVED

(*Concluded from page 50*)

tion to eutectoid is accompanied by evolution of heat. The mode of formation of pearlite will be discussed in greater detail in a later section. Meanwhile let us examine the nature of pearlite.

It has been established that in the straight iron carbon alloys (such as carbon steels) pearlite contains about 0.85 per cent combined carbon. Different investigators disagree slightly on the exact percentage of carbon but practically all agree that it is between 0.80 and 0.90 per cent. This means that at 0.85 per cent carbon an alloy composed only of iron and carbon is wholly pearlitic. Since cementite contains about 6.67 per cent carbon and pearlite 0.85 per cent carbon, it is seen that pearlite is composed of nearly 13 parts of cementite associated with 87 parts of ferrite—or 1 part of cementite to 6.7 parts of ferrite.

Terms Used for Steel

Therefore, iron carbon alloys, such as the carbon steels, containing less than 0.85 per cent carbon are not wholly pearlitic, but contain an excess of ferrite—apparent as free ferrite previously described. Such steels are termed *hypo-eutectoid* steels When they contain 0.85 per cent carbon and hence are fully pearlitic, they are called *eutectoid* steels When considerably over 0.85 per cent combined carbon is present, it is evident that cementite is in excess. This excess shows up as *hyper-eutectoid* cementite. Such a steel is termed *hyper-eutectoid* steels. These same terms are applied to the matrix of gray iron, excluding steadite from consideration. If wholly pearlitic, the matrix is called an eutectoid matrix, if free ferrite is present it is known as an hypo-eutectoid matrix, etc. Presence of exactly 0.85 per cent combined carbon is not always necessary for formation of an eutectoid (fully pearlitic) matrix in gray iron.

Pearlite is strong and rigid and possesses some ductility. Jefferies and Archer suggest the following for *normal* pearlite, i.e., the more usual finely laminated form:

Tensile, pounds per square inch	120,000
*Prop. Limit, pounds per square inch	50,000
Elongation in 2 inches	15 per cent
Reduction area	30 per cent
Brinell	225

*(This is somewhat below the ordinary elastic limit.)

More finely laminated pearlite possesses greater strength and it also is probable that pearlite in cast irons, which contain considerable silicon, is somewhat stronger than straight *iron carbon* pearlite.

Like the pearlite in steels, pearlite in gray irons generally possesses the characteristic laminated eutectoid appearance. However, in gray irons an effectively pearlitic matrix may occur with combined carbon as low as 0.50 per cent, to as high as about 0.80 per cent according to the iron. There are two reasons for this condition. First, graphite and steadite take up space and volume. For example, an iron may contain say 12 per cent graphite and 5 per cent steadite by volume, the balance 83 per cent by volume being pearlite. If the pearlite in itself contains 0.85 per cent carbon, the metal must have (1.00- .17) x 0.85 per cent combined carbon to be fully pearlitic—or about 0.71 per cent combined carbon. (.83 × .85 = .71). Second, certain elements, such as silicon, alter the amount of carbon necessary for an eutectoid structure.

Pearlite in gray irons often varies considerably in appearance, even in the same sample. Laminations may be extremely close as in Fig. 22 or distinctly or widely laminated as in Fig. 15. The cementite structures may exhibit a somewhat acicular arrangement, Fig. 23, or may appear largely spheroidal, Fig. 17. The graphitization reaction takes away much of the carbon from the cementite and it is not unusual to find largely ferritic crystals showing a few widely separated cementite lamellae, Fig. 24.

The various pearlite formations form aggregates or grains, with boundaries resembling the ferrite grain boundaries. These grain boundaries can be shown by suitable manipulation, and readily sketched in, as in Fig. 16. Often they are not so clearly apparent. However, it readily is noted that the laminations change in direction from grain to grain, thus indicating the boundary lines. General grain size of pearlite depends largely on the cooling rate of the castings, although it is influenced by other factors.

There has been considerable propaganda relative to the value of a pearlitic matrix in gray iron and patents have been issued covering processes whose aim is the production of a pearlitic matrix. While a pearlitic matrix is somewhat harder and offers better resistance to wear than a highly ferritic matrix, a pearlitic matrix does not by itself necessarily indicate a stronger and more rigid iron. Furthermore, most *normal* cast irons contain a matrix which is pearlitic or nearly so. This has been described by Everest—*Foundry Trade Journal*, May 21, 1931, page 355—as follows: "It is a matter of common experience that as increasing amounts of one of the softening elements (i.e. silicon, nickel, aluminum) are added to cast iron, the proportion of graphite to combined carbon does not change in direct relationship to the amount of added element, but a relatively stable condition in the iron is found when the combined carbon is between 0.50 and 0.70 per cent as shown in Fig. 21. This curve emphasizes that the pearlitic condition in cast iron is stable and persists over a wide range of composition. If accordingly the curve combining cooling rate and combined carbon is drawn, it is found that once again this curve has the same form as that found from a consideration of composition and combined carbon. It is accordingly evident that the pearlitic or stable range in gray cast iron is persistent, not only over a wide range of composition but also is the stable condition over a wide range of cooling rate, and it is a matter of practical experience that the pearlitic condition is the natural condition in castings with normal compositions and section thicknesses."

Pearlitic structures seem in some gray irons hardly to comply with all the requirements for definition as a true eutectoid. For example, it is quite evident that some types of pearlite grains contain more cementite lamellae than others, hence are likely to contain more combined carbon and vice versa.

Descriptions of sorbite and martensite, forms occurring during the transformation of austenite toward pearlite were presented in an article by the author in August and September, 1934 issues of THE FOUNDRY.

Interest High In Contest Start

(*Concluded from page 23*)

second and $25 for third, to be paid to the writers of the three best articles which give in detail some foundry practice of definite value. These articles, covering the production of gray iron, steel, malleable or nonferrous castings, are to be written by someone actively employed in a foundry, and may be related to any phase of molding, coremaking, melting, heat treating, cleaning, rigging, pattern making or handling. Entries other than those receiving the special awards will be studied for their availability to be published at regular space rates. The contest, announced as opening March 15 will close August 1 in time to permit the awards to be announced in the September, Post-Convention, issue of THE FOUNDRY.

The discovery of new ideas, the broadcasting of improvements in foundry practice and the recognition in a substantial way of those who have been thinking and building during the period just passed, provide the motive for this contest. Undoubtedly, new landmarks in foundry progress will be established by the articles which are contributed. And new names will emerge to take their places with those grand old pioneers, West, Keep, Boland, Sleeth, Moldenke, Outerbridge, and writers of today who still are vital, active factors in advancement of the industry, prominent leaders in the foundry world.

Safety Program Shows Results

(*Concluded from page 22*)

walls and inserts were included in the pay envelopes. Periodically, letters are distributed to all employes containing a message on some particular phase of accident prevention. Emphasis is placed on the definite benefit the individual will derive from practicing the suggestion. The publicity program is varied as much as possible to hold the interest of the men and thus offset the lack of interest incident to mere routine.

Good housekeeping is an important factor in the program. Orderliness trains a man to think and experience shows that a thinking man is a safe man.

All men must wear safe toe shoes. Employes in the cleaning and chipping departments, men working at roll turning lathes and other machines, are compelled to wear goggles. A set of rules was established to enforce discipline and to govern infractions. Foremen are held directly responsible for the observance of these rules.

As a direct result, outstanding savings on compensation and medical payments to date include $24,318.00 on eye cases alone. On accidents involving feet saved by safe toe shoes, the direct saving has amounted to $14,700.00.

In 1931 the Garrison plant worked 168 days without a lost time accident. The next no accident period extended over 186 days. The Midland, Pa., plant set up a record of 466 days without a lost time accident, from March 22, 1932 to July 22, 1933. The best record of the Garrison plant covered 670 days, from Dec., 1931 to Oct. 17, 1933.

Both plants have won several contests in the foundry division of the Western Pennsylvania Safety council for six month periods. Garrison plant, in the iron foundry division, won second place in the 1932 National Safety Council contest, and the national bronze trophy in the 1933 contest. Midland plant won second place in the steel foundry division National contest, 1932 and third place in 1933-34. At the end of December 1934 Midland plant held second place and Garrison plant third place in the foundry division. This contest closes June 30, 1935. A collection of badges, trophies and other emblems of merit, shown in the accompanying illustration, is displayed in a prominent place in the Garrison plant, Pittsburgh.

Frequency and severity rates of the three plants for the years 1930-34 inclusive are shown in the accompanying table. They present tangible evidence of what can be accomplished when the management realizes the value of the safety movement as an economic asset. The collection of shattered goggle lenses shown in Fig. 2 constitutes a practical object lesson. In addition to saving the eyes of the men who wore them, they represent a saving of over $24,000.00 in compensation claims.

Frequency and Severity Rate

	Iron Foundry		Steel Foundry		Machine Shop	
	Frequency Rate	Severity Rate	Frequency Rate	Severity Rate	Frequency Rate	Severity Rate
1930	25.73	0.635	25.90	9.25	50.82	0.353
1931	11.49	0.327	15.89	5.35	37.41	0.351
1932	.....	.....	12.39	0.111	20.91	0.245
1933	4.11	0.369	7.50	21.25	31.52	0.336
1934	3.27	0.08	11.84	0.275	12.71	13.31

These exposure rates are figured on the National Safety council basis of 1,000,000 hours exposure for frequency and 1000 exposure for severity.

Study Unsoundness In Aluminum Castings

Dr. Harold Moore, director of the British Nonferrous Metals Research association, presided over the twenty-seventh annual general meeting of the British Institute of Metals, held in the hall of the Institution of Mechanical Engineers, London, on March 6 and 7.

A paper presented during the morning session of March 7 was entitled: "Unsoundness in Aluminium Sand-Castings. Part III—Solidification in Sand Moulds Under Pressure," by Prof. D. Hanson, vice president of the Institute and professor of metallurgy at Birmingham university, and Dr. I. G. Slater, of the British Nonferrous Metals Research association. By allowing aluminum alloy melts to solidify under pressure in sand molds, ingots showing less unsoundness and higher density may be obtained. A pressure of from 50 to 100 pounds per square inch (dependent on the initial unsoundness of the metal) is sufficient to remove all visual traces of pinholes from a 3-inch x 3-inch diameter sand-cast ingot. The densities of ingots cast at higher pressures are appreciably greater than those obtainable in ingots poured from melts treated by various degassing processes.

Tensile properties of certain sand-cast alloy test-bars are considerably enhanced by solidification under pressure. On heating a certain pressure-solidified alloy to temperatures between the solidus and the liquidus, the presence of gases retained in the ingot is shown by the appearance of blisters and cavities. The net effect of solidification under pressure appears to be the squeezing up of the pinholes, which normally would be formed, to smaller dimensions. At the same time, the casting is more completely fed, and shrinkage is confined to one local area. The principles now discussed are probably applicable to all metals and alloys, whether sand- or chill-cast.

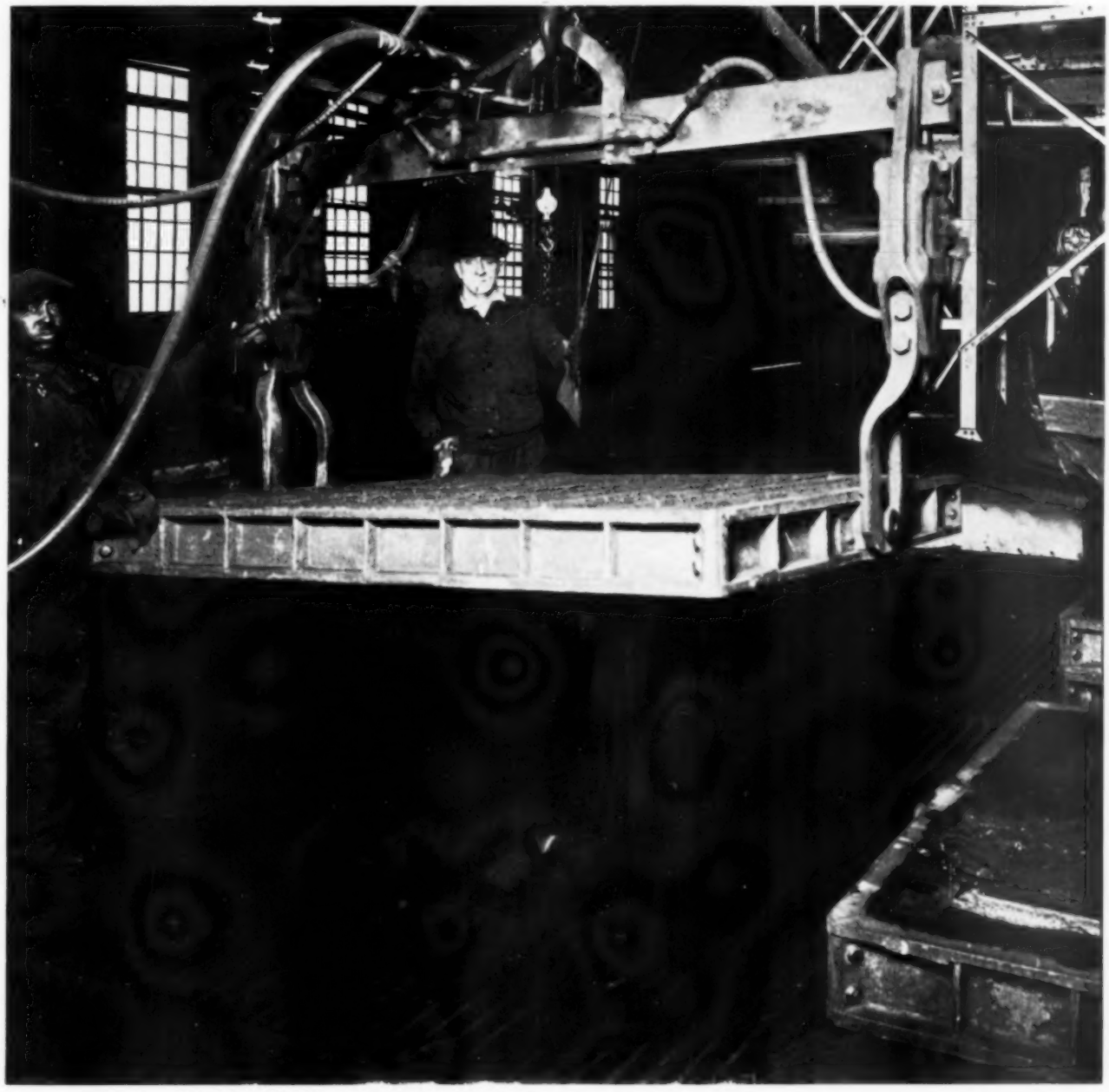
The immediate practical considerations which arise from these observations may be summarized as:

(a) A method for the production of aluminum alloy castings, which may be produced from melts of indifferent quality as regards gas content, whereby the castings are free from pinholes. This effect will operate independently of the rate of cooling as determined by the material of the mold and the size of the casting. In addition, the castings will have enhanced physical and mechanical properties.

(b) A method for the production of castings which are free from isolated shrinkage cavities. It will be necessary to allow for the additional volume of metal required due to the increased total shrinkage. This is a matter of simple foundry technique in the provision of adequate feeding gates and in the design and lay-out of the mold, whereby solidification proceeds progressively and is finally completed in such feeding devices. This application is not only confined to sand-castings, but also to chill-castings.

The gist of the discussion that followed this paper was to the effect that it is much better to make good sound metal from the start, without gas inclusions, than to endeavor to discover methods enabling unsound metal to be utilized. It was also pointed out that the autoclave method suggested in the paper was too complicated to be utilized for practical purposes in foundry operations. On the other hand, it was emphasized that the investigation work of the authors had very definite value, inasmuch as they had endeavored to isolate certain factors bearing on the subject of unsound castings, thus adding this little knowledge to the literature already published on the subject.

Stoney SHAKEOUT BAILS



For All Sizes of Flasks
Built to Suit Your Requirements

The Stoney

Foundry Engineering & Equipment Co.

5321 St. Clair Avenue **Cleveland, Ohio**

Determines Iron Lost in Melting

(*Concluded from page 26*)

analyses, and the weight of carbon burned.

Since there is the same weight of carbon in unit volume of CO_2 as in CO, the relative volumes of those gases give the proportion of carbon burned to CO_2 or to CO.

With the Poumay, 18 parts out of a total of 18.12 parts of the carbon burned took 32/12 times its weight of oxygen to CO_2, while 0.12 parts took 16/12 times its weight of oxygen in becoming CO.

Assuming the coke to contain 90 per cent carbon and as coke to the extent of 7.17 per cent of the weight of metal was used for fusion, this gives 144 pounds of coke, containing 129 pounds of carbon per ton of iron.

Hence there is $129 \times \frac{18}{18.12} = 128$ pounds carbon in CO_2 of the gas with 0.86 pounds in the CO.

Then $128 \times 32/12 = 342$ pounds oxygen added to $\frac{0.86 \times 16}{12}$ or 1.15 gives a total of 343 pounds of oxygen in the carbon gases. The ratio of nitrogen to oxygen in the gases shows that 14.67 per cent of oxygen was missing. The blast used therefore must have contained 402 pounds oxygen. Deducting the oxygen in the gases from this, we get $402 - 343 = 59$ pounds of oxygen taken up by metal, and disappearing in the slag for each ton of cast iron handled.

Iron Lost in Slag

Gas from the ordinary cupola in which 10 per cent equal to 200 pounds of coke were used per ton of iron contains 98 pounds of carbon in the CO_2 and 82 pounds in the CO, calling for 262 + 108 pounds oxygen = 370 pounds. As 10 per cent of the oxygen disappeared, the blast oxygen must have been $\frac{370 \times 100}{100 - 10}$ = 411 pounds. As before 411 − 370 = 41 pounds of oxygen taken up by metal and leaving in the slag — per ton of cast iron.

Those figures must not be taken as absolutely accurate. No account is taken of the carbon in the gas, which comes from the limestone and the amount of which is not stated. A slight correction also is needed for the free oxygen present, but these corrections could not affect the comparison seriously.

Apparently 36 pounds of expensive coke was saved per ton of iron melted, but the *extra* 18 pounds of oxygen which disappeared from the gases per ton of iron melted, is capable of converting 62 pounds of pure iron to ferrous oxide. About twice the weight of coke saved, may be lost in the extra cast iron oxidized. In such a case saving coke means loss of money.

More air is required, calling for appreciably more power, while the cupola demands closer and more skilled attention, with some type of indicator to show the volume of blast.

Since oxidation by the *blast* to some extent is unavoidable, it may be interesting to note what happens when cast iron of average composition is burned by the oxygen blast.

Burned by the Blast

Although silicon has greater affinity than iron for oxygen, it is evident that the iron must be oxidized before the smaller quantities of manganese, phosphorus etc. can be attacked. Oxygen taken up by the various elements is shown in Table II.

As little or no phosphorus appears in cupola slag, it may be assumed that the oxygen taken up by phosphorus is transferred to the carbon and so appears in the gases. The small quantity of sulphur may be ignored. The table shows that of 49.751 parts of oxygen taken up when 100 parts of iron are burned by the blast, 11.145 parts or 22.4 per cent are restored to the gas, while 38.606 parts or 79.6 per cent become nongaseous.

Sir I. Lowthian Bell proved by repeated experiment that CO_2 gas oxidized metallic iron even at temperatures below 450 degrees Cent. (842 degrees Fahr.) With cupolas using extra large volumes of air per pound of coke, oxidation of iron, and silicon by CO_2 must occur to some extent. It should be noted further that hot iron protoxide readily takes up oxygen from the blast, but in cupolas run without a receiver, this excess oxygen will be transferred to carbon and will be found in the gas.

In similar fashion magnetic oxide of iron (Fe_3O_4) formed by the action of the blast on metallic iron will be reduced to ferrous oxide (FeO). It is quite obvious that the missing oxygen carries away the greatest possible proportion of iron.

When large proportions of steel scrap form part of the metal charged, as in cupolas supplying metal to Tropenas converters the conditions are different.

Although the metal comes from these cupolas in liquid form, a considerable amount has not been really fused, but has been dissolved by the more easily fused pig iron. With large pieces of scrap in the charges the oxidation losses are heavy, but are to some extent hidden by the carbon taken up by the metal from the hot coke in the bed. Metal in several cases increased in carbon 0.75 per cent. No doubt this increase often is exceeded, depending on the temperature in the cupola below tuyere level. The temperature is lowered to a considerable extent when a large piece of unfused steel finds its way there, to await solution by the liquid metal around it.

If the blast were heated a few hundred degrees before use in such circumstances, one is convinced that much less trouble would be experienced and a lesser loss sustained. We never could hope to have such complete recovery of the reoxidized metal as is found in the hot blast furnace, where similar oxidation occurs, as the ultimate reduction of oxidized metals depends on peculiar reactions in the well of the furnace.

It is extremely difficult to secure accurate weighing of all supplies of metal as charged and as melted. The method used in the foregoing presentation is advanced as a solution of the problem of estimating the real melting loss in cupola work, a problem which seems to have had comparatively little study.

Foundrymen Hear Talk on Brass Practice

John G. Melbrod, Federated Metals Corp., Chicago, addressed members of the Northern Illinois Foundrymen's association at a meeting held March 12 at the Elks club, Rockford, Ill. Mr. Melbrod discussed "Brass Foundry Practice", dealing particularly with the practical aspects. The following points were emphasized: Necessity of chemical laboratory control of the metal; proper gating to produce solid castings free from inclusions; control of melting operations with a definite time for pouring; avoiding overheating; use of a temperature chart for the different classes of work; and deoxidizing operations previous to the pouring.

Builds New Plant

Ruemelin Mfg. Co., Milwaukee, recently has moved to new headquarters at 3850 North Palmer street. The new building, which the company has erected, will provide more floor space, more head room and modern facilities for the production of its line of foundry blasting equipment, dust filters, exhaust fans, cabinets and room type equipment.

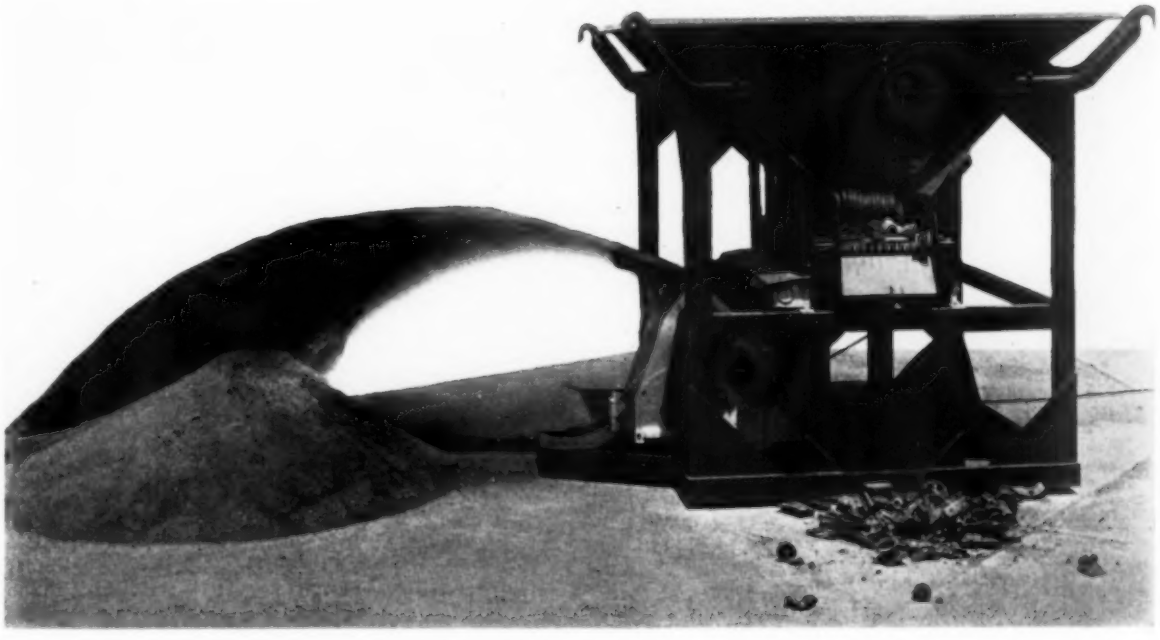
75% Reduction in Labor

through the use of

The Royer Sand Separator and Blender

in combination with

The Royer Scrap Remover



This tremendous reduction in sand conditioning costs is reported by a large steel foundry in the East after using a Royer Combination for the past nine months.

The Royer Combination being a portable unit requiring no expensive pits or foundations makes it possible for every foundry to obtain Royer Conditioned Sand at an immense reduction in cost on a very moderate investment.

Entirely mechanical in operation this unit operates with equal efficiency in both ferrous and non-ferrous foundries.

Manufactured in two sizes 30 and 50 tons of sand per hour.

Write today for detailed information on Royer Sand Conditioning Equipment.

ROYER FOUNDRY & MACHINE CO.

158 Pringle Street ROYER PRODUCTS RECOMMEND THEMSELVES **Kingston, Pa.**

Cleans Foundry with Suction

(*Continued from page* 30)

battery of 17 oil fired crucible furnaces made by Alfred Fisher Furnaces Inc., Chicago, and set up in a shallow trench at the north end of the foundry building, as shown in Fig. 5. It is claimed that method of handling the metal permits greatest flexibility, either in melting the charge or in distribution of the molten metal and is particularly applicable where the majority of the molds are poured on a moving conveyor. To meet peak production schedule, an average of six heats per day is secured from each of the No. 80 pots, individual capacity 250 pounds. Variations in the amount of metal required daily are met by suspending operations in any required number of furnaces. Under normal conditions the pots are lifted in close rotation to pour the molds as they accumulate on the conveyor. The plate conveyor is driven by a motor and reduction gearing located at the shakeout end. Remote push button control enables the pourers to stop the movement temporarily if necessary. Under normal conditions metal is poured while the conveyor is in motion.

Employs Whirling Flame

Lining of the furnace is barrel shaped with the greatest diameter at the bottom. The burner is located near the center of the drum and fires tangent to the inside of the lining. The flame does not strike the crucible but passes completely around it. The flame also is tilted downward so that the flame travels around the furnace bottom thus creating the highest temperature where it does the most work and uses the least fuel. Air for combustion is supplied by two pressure type blowers driven by 10 horsepower motors. Usual air pressure is 18 ounces. Fuel oil, 18-20 Be. and 18,900 B.t.u., per pound, preheated to 180 degrees Fahr., is supplied to the burners at 32 pounds pressure from a single pump serving the entire battery of furnaces.

The average charge is 250 pounds, made up of 75 per cent ingot and 25 per cent return scrap. The composition of the charge is 85 per cent copper and 5 per cent each tin, lead and zinc. No. 80 crucibles show an average life of 70 heats. The furnace crew is made up of four men. Furnaces are fired for about 2 hours in the morning before the first heat. Metal for each charge thereafter is melted in about 50 minutes at a temperature of approximately 2300 degrees Fahr. Daily average output for each furnace is 1250 pounds.

Furnaces are relined about once a year and the covers every four weeks. Average daily consumption of oil for each furnace is 20 gallons, or 4 gallons per heat after the first heat.

The crucible is lifted with a pair of tongs suspended from a light chain block hooked into a carrier on a monorail supported by wall brackets directly above the furnaces. Through suitable switches this section of the monorail is connected to two main lines on opposite sides of the shop. One line is located above the outer edge of the conveyor unit and is used for conveying metal to this section of the foundry. The second line is used for carrying the pots to a number of parallel pouring stations in the east section of the shop. From this second main line the chain hoists and pots are switched to comparatively short monorail sections extending over each floor. For convenience in pouring the metal, the molds are placed on long, narrow concrete blocks extending about 12 inches above the floor level.

The tongs employed for lifting the pots from the furnaces are provided with double claws which grip the pot above and below the bilge. These claws are adjusted periodically over an iron form to take up the spread and insure a snug fit around the pot. After the pot is lifted from the furnace it is lowered into the usual type shank, a ring of the proper size to encircle the pot below the bilge. A straight extension from one side of the ring is for the use of the man who steadies the pot. An extension on the opposite side terminates in two handles for the use of the man who does the pouring. The assembly is picked up by a bail. A short steel bar, hooked at the upper end, is attached to a hinge on the side of the shank ring. The hook engages the upper edge of the pot and prevents it from slipping or falling out of the ring when the pot is tilted from the vertical to the horizontal position.

New Sand at Shakeout

Molds are made on a battery of 17 squeeze strip type machines supplied by the Tabor Mfg. Co., Philadelphia. Patterns are mounted on metal plates and wherever possible are arranged symmetrically so that cope and drag may be formed on the same plate. Sand is No. 1 Albany, sufficiently open to permit free venting and yet close enough to product a clean smooth skin on the castings. New sand for rejuvenating the supply is added at the shakeout station. It is taken aloft in the elevator which discharges into the mixing and aerating apparatus and then passes into the stream of sand flowing in the conveyor over the mouths of the hoppers located above the molding machines. At the tempering station an attendant sprays the sand with the amount of water required.

Cores are made in a section of the building separated from the foundry proper by a court or driveway. One section of the core room is set apart for sand storage where the various classes of sand are protected from the weather. Most of the cores are made from a fine grade of sharp sand with varying additions of bank sand to supply the necessary green bond. A more refractory grade of silica sand is used in the cores for nickel and monel metal castings. Cores are dried in a battery of oil fired drawer type ovens. Accurately machined metal coreboxes are employed by the girl coremakers who develop remarkable speed and skill. Male attendants prepare the sand mixtures in a small muller type machine made by the National Engineering Co., Chicago.

Dried two-part valve cores are assembled in sand forms instead of the usual metal forms or the occasional make-shift device. A small wood frame is placed around one of the patterns and packed with core sand. This block of sand is dried, a replica of the drag half of a mold with the prints in proper position. The first part of the two-part core is placed in this form which locates it accurately in position. A little paste is applied to the connecting member and the second part of the core is located in place where it is established accurately in the prints. The assembled core then is given a slight supplementary drying in the oven to harden the paste.

Knock Out the Cores

Gates of valve castings with the cores still in place are trucked from the shakeout to a cabinet located close to the wall in the southwest corner of the shop where a pneumatic hammer has been adapted to serve as a vibrator. The gate of castings is suspended vertically from a hook where the rapid blows of the hammer on the sprue effectually loosens the sand. Any dust arising from the operation is collected under a hood and exhausted through a large pipe at the back of the cabinet. The sand drops to the floor and is wet down and removed periodically.

The coreless castings then are trucked a short distance to a water tumbler where the skin is polished and where any remaining traces of sand are removed from the surface inside and outside. Manifestly no dust is generated during this process, one of the reasons for adopting this cleaning method. As originally installed, a stream of clean water entered the barrel through the trunnion at one end. The overflow passed out through the trunnion at the opposite end. When the barrel came

(*Concluded on page* 61)

ADVERTISING PAGES REMOVED

(*Concluded from page* 58)

to rest at the end of the cleaning period, it contained water up to the center line, which had to be dumped before all the castings could be removed.

This feature has been eliminated by providing a number of narrow slots at the periphery of the discharge end of the barrel. A shield on the outside prevents the water from gushing out in a horizontal direction. The muddy water issuing from the openings strikes the shield and is deflected downward into a long trough. The mud settles to the bottom and is removed as occasion requires. The barrel is drained of water in a few seconds after it comes to rest.

A hopper on rollers and track is mounted directly below the barrel. The load of castings is dumped into the hopper, which may be rolled back for sorting the castings while the following load is revolving in the tumbling barrel for the necessary cleaning period.

Chicago Engineers Told of Applications for Ferrous Castings

A CONCISE yet vivid picture of improvements which have been made during recent years in the quality of ferrous castings was presented to an audience of about 450 engineers, foundrymen and executives at a meeting held in the Engineering building, March 18.

This session, devoted to the subject, "Engineering Uses of Modern Cast Metals", was a joint gathering of the Chicago section, American Foundrymen's association, the Western Society of Engineers and the Chicago section, American Society of Mechanical Engineers. A. M. Houser Jr., Crane Co., Chicago, was chairman of the joint committee in charge of arrangements for the meeting, while H. F. Allen, Link-Belt Co., Chicago, presided. Three papers, covering gray iron, malleable iron and steel castings, were presented. Due to time limitations, each was confined to treating the important features of the properties and uses of the various metals.

Refers to Use of Alloys

Gray iron was discussed by H. Bornstein, Deere & Co., Moline, Ill., who described briefly common practices in production of such castings. Pointing out that while the majority of gray iron castings made today still are unalloyed, he emphasized the growing importance of alloyed iron for many engineering applications. Such alloys include nickel, chromium and molybdenum. Increased use of these and other alloys was predicted. In discussing high-test irons, Mr. Bornstein related that several years ago few foundries could meet tensile strength sbpecifications of 50,000 pounds per square inch, while today strengths of 60,000 pounds and higher commonly are attained.

The speaker's talk was illustrated by slides showing various castings applications, including automotive cam and crank shafts and brake drums, stamping dies and piston rings. In connection with crank shafts, the ability of cast iron to absorb vibration was given as an important advantage for its use in production of such parts.

Malleable iron castings have a definite field of application, where they enjoy certain superiorities over other cast or rolled metals, stated D. P. Forbes, Gunite Foundries Corp., Rockford, Ill. Malleable iron has a uniform tensile strength ranging from 50,000 to 60,000 pounds per square inch, and has a yield point which is a high percentage of the ultimate strength. Because of its combined qualities of high strength, resistance to shock and ease of machinability, malleable iron finds many uses in the automotive, railroad, agricultural equipment and miscellaneous industries, Mr. Forbes indicated. On automotive vehicles, such parts as the front hub, pedals, spring brackets, differential carriers and cases, brake parts and numerous brackets, levers and supports on the chassis and motor commonly are malleable castings. The tendency in the automotive industry the past few years has been for an increasing use of malleable iron.

Mr. Forbes pointed out that malleable is best suited for castings of light sections and on some heavier pieces it becomes an optional material, yet it finds extensive use for railroad equipment parts. For applications on agricultural machinery, corrosion resisting properties of malleable iron offer an additional advantage over some other materials. Miscellaneous uses of malleable iron are numerous, some of these being lawn mower gears, conveyor chains, pipe fittings, bolt anchors for cement construction, bridge railing panels, fence fittings, manhole covers, small machine tool parts, electrical outlet boxes, cable clamps, barrel plugs and a wide variety of machine parts.

"Advancements in metallurgy have disclosed that the same process which forms malleable iron will form other valuable products if the method of manufacture is varied." Mr. Forbes stated. "Products have appeared which are similar to malleable iron, except that they contain up to 0.80 per cent combined carbon, as against practically none for malleable iron. The utility of these products is great since care in manufacture will permit of high tensile strength with a reasonable ductility. A typical example of such a material would have a tensile strength of 90,000 pounds per square inch, a yield point of 70,000 pounds and elongation of 16 per cent in 2 inches.

The resume of progress in the steel castings industry during recent years was presented by A. N. Conarroe, National Malleable & Steel Castings Co., Melrose Park, Ill. The speaker described the work which has been done in studying and improving steel foundry practice, detailing various methods of heat treatment as well as the effect of alloys on physical characteristics of castings. Properties of vanadium, manganese, chromium, molybdenum, tungsten and nickel steels were listed. Developments in heat treatment and in alloying of steel castings have done much to enlarge the usefulness of the metal, Mr. Conarroe indicated.

Replaced by Castings

Due to the high yield strength of steel castings, they can be used to replace structural members successfully with a material saving in weight for the same condition of service, or the loads may be increased for the same size of section, when properly designed. Castings should be designed with a view for strength and reliability rather than for their esthetic appeal. The possibility of substituting integral castings for fabricated structures is shown in the cast locomotive frame, though the speaker warned against carrying size and complexity too far.

Corrosion resisting steel castings, principally alloyed with chromium and nickel, were discussed, including the principal applications of the various mixtures.

An exhibit of modern castings, furnished by leading foundries of the Chicago district, proved an interesting feature of the meeting.

Companies participating in the exhibit included: Chain Belt Co., International Harvester Co., Illinois Iron & Bolt Co., Chicago Steel Foundry Co., Sivyer Steel Casting Co., Greenlee Foundry Co., Continental Roll & Steel Foundry Co., Chicago Hardware Foundry Co., Chicago Railway Equipment Co., Nichol - Straight Foundry Co., Burnside Steel Foundry Co., Western Foundry Co., Gunite Foundries Corp., Grand Rapids Malleable Works, Campbell, Wyant & Cannon Foundry Co., Deere & Co., Pettibone Mulliken Co., American Steel Foundries, Crane Co., and Chicago Malleable Castings Co.

Advocates Round Sand Grains

(*Concluded from page* 31)

agree with this claim. We use one type of sand for facing and backing. This is rammed very hard and the resulting mold is bound to be uniformly hard and true to pattern. The casting is square and true and not over weight. Surfaces of the castings are smooth. Our new sand is a washed, graded, dried, round grain silica sand with exceptionally high silica content. Seventy per cent or more should be retained on a 40-mesh sieve and not more than 5 per cent pass through a 60-mesh sieve. The mold surface prepared from round grain sand is impervious to the cutting action of the metal, because the surface is uniform and hard. This sand presents a solid front without any weaknesses in its structure, or any sharp angles or wedges for the metal to force an opening between the sand grains.

Green Sand Preferred

Where the angular type sand grains forms the mold surface, the metal breaks down the little points and angles and besides losing fines that are formed, more sharp angles are formed on the mother grain where the fines were broken off. In one typical instance several years ago we lost 7 per cent of the total sand introduced on the first pass when a sub-angular grain sand was run through the sand cleaning system. A properly prepared synthetic green sand is the ideal sand to use where the casting is to withstand strong, internal pressure. Proper green sand has a tendency to freeze the metal and promote even cooling and shrinkage, even where the sections are not uniform.

Leaks occasionally show on pressure castings. Fracture of a broken casting may not reveal any apparent reason for the defect. Good green sand, and not dry sand will help to overcome this condition. A green sand mold is plastic and yields when the metal is solidifying, while dry sand is resistant and will cause weakness in the grain of the metal, strains, cracks and excessive fins.

Rusty or oxidized nails and chills, internal or external, cause porosity in steel castings. The defect may appear in the immediate vicinity of the chill, and it may show up as far away as 6 inches. Chills in constant use should be tumbled or sandblasted periodically to remove the oxide scale. Moisture on a clean chill is not likely to cause any grief because the heat from the metal evaporates the moisture before the chill is covered.

Cutting of a mold face usually will cause even a well deoxidized steel to become *wild*. If the cutting action does not cease early we either have dirt accompanied by porosity in its worst form, or the mold begins to blow. Metal getting under the skin of the mold sets up a violent disturbance.

Metal to be poured into castings should be thoroughly killed. Steel abnormally low in silicon will attack the silica coating on mold or core and cause disturbance throughout the casting. Proper green sand sometimes will overcome a wild tendency on the part of the metal. This no doubt is due to the lack of resistance encountered when the metal flows across the mold face, and to the excellent venting property of the sand.

On a casting, perfect except for a small area where porosity was emphasized, thorough examination revealed that the molder had pounded the sand on the pattern and literally powdered the sand under the peening action of the air rammer. The permeability in this area was destroyed and when the metal came into contact with it a violent disturbance occured because of lack of vent. Instances of this kind result in scabs.

In many instances a kick or disturbance in the mold will not reveal itself in any form, usually because a good green sand will absorb the shock through the uniform and free venting properties of the round grain sand facing. A small gate may not permit molten metal to enter the mold in sufficient volume. The metal will become oxidized and porosity is the result. Usually the mold face, cope and side walls will pull down and as a result sand and silica become bedded in the surface.

A mold should be poured as quickly as possible. This not only promotes homogenous steel but causes inclusions—if any—to float up into the risers provided with generous fillets at their junction with the casting. Where coke is rammed in a mold or core, and where, through carelessness, the coke either becomes exposed or lies too near the surface, the molten steel will attack the carbon in the coke and set up a disturbance.

Prevent Porosity

DISCUSSING causes of porosity and other forms of defects in steel castings the author stresses the value of round grain sand which insures a higher permeability than sand with angular grains. The higher permeability permits hard ramming with a consequent production of castings true to shape and weight. Green sand also may be used to advantage in many instances where former experience may have indicated the necessity of drying the molds. This article is abstracted from a paper presented by D. D. Cameron, general superintendent Pratt & Letchworth Co., Buffalo, before the Pittsburgh Foundrymen's association March 18, 1935.

Chicago Section Discusses Heat Treatment

"Steel and Differential Heat Treatment" provided the topic for discussion at the monthly meeting of the Chicago section, American Foundrymen's association, held at the Medinah club, March 7. The subject was presented by A. W. Gregg, foundry manager, Bonney-Floyd Co., Columbus, O., and the discussion was led by H. A. Forsberg, Continental Roll & Steel Foundry Co., East Chicago, Ind. About 60 attended the meeting.

Mr. Gregg traced the rapid development in heat treatment since the days when quenching was practiced in rain-water barrels, to the present when some steel castings producers quench and draw about one-half their total output. The following advantages of quenching and drawing were brought out in the talk and discussion.

1. An increased factor of safety is realized due to the superior properties of the castings.
2. Redesign of the castings, with reduction in weight and simplification of the pattern, sometimes is possible.
3. Cheaper grade of steel may be used by normalizing.
4. Such castings may be substituted for forgings in some cases.
5. Full latent properties of alloys are realized.

Improvements in furnace design have made close control possible in heat treatment, the speaker indicated. Heat treatment of castings is an important factor in machineability, a quench and draw to 160 brinell giving better qualities in this respect than a casting annealed to 150 brinell. Losses from water cracks in quenching are practically negligible, it was stated; quenching, in fact, shows up hair checks otherwise not seen and is the customer's best protection against defective work.

Flame hardening was suggested to have important possibilities in heat treating, particularly as it affects internal sections, and appears to offer a relatively higher brinell than quenching and drawing.

SEND THIS COUPON

NORTON COMPANY,
Worcester, Mass.

Please send to me your new bulletin giving full information about NORBIDE PRESSURE BLAST NOZZLES—their cost saving features, their sizes and prices, their selection and use.

NAME .....

FIRM .....

ADDRESS .....

.....

AN-9

Distributors for
NORBIDE PRESSURE BLAST NOZZLES

PANGBORN CORPORATION
Hagerstown, Md.

RUEMELIN MFG. CO.
Milwaukee, Wisc.

THE W. W. SLY MFG. CO.
Cleveland, Ohio

THE MAC LEOD CO.
Cincinnati, Ohio

FIFTIETH
NORTON
YEAR
1885-1935

NORTON

Analyzes Profits by Customers

(*Concluded from page 27*)

Equals average actual cost per pound	4.7	cents
Sales value	$2,400.00	
Less standard cost	2,000.00	
Leaves — standard profit	400.00	
Sales price per pound	4.0	cents
Less standard cost per pound	3.3	cents
Leaves standard profit per pound	.7	cents
Actual cost	$2,800.00	
Less standard cost	2,000.00	
Leaves actual operating loss	800.00	
Actual cost per pound	4.7	cents
Less standard cost per pound	3.3	cents
Leaves actual operating loss per pound	1.4	cents
Actual operating loss	$800.00	
Less standard profit ..	400.00	
Leaves—net loss	400.00	
Operating loss per pound	1.4	cents
Less standard profit per pound	.7	cents
Leaves—net loss per pound	.7	cents

This procedure is followed for each month, placing the report in the book, one position down with the last month's figures showing.

Cumulative total of all preceding months is carried down to the master sheet. The last total for December being the report of the year's sales. Companies using other accounting periods could use the same procedure by rearranging the cumulative total lines.

At the close of the year's business these sheets, with other reports set up in a similar manner, are removed from the binder and permanently bound for future reference.

A few observations will show the usefulness of this report. Company *A* shows exceptional profits. The sales department was able to secure the business at a splendid price (10 cents a pound) or 2 cents per pound over the standard, or normal cost. The operating department also added to the net profit by producing 1 cent a pound less than the standard cost. Although the volume of business is only 2 per cent of the total month's shipments, this report shows that *A* is a profitable customer and suggests that the sales department direct its activities toward securing more of that type of work.

Analyze the Cost

Company *B* with 45 per cent of the shipments, shows a normal 8 cents a pound net profit but the sales department secured the entire amount. With standard costing rates set to allow the operating departments opportunity to better the standards, they did not avail themselves of it. Notwithstanding, company *B* is a good customer, and this showing suggests careful analysis of the various patterns to see if future profits can be enhanced by the possible rearrangement of the equipment or operation.

C is a new company. Standards on most of the jobs were set in accordance with tooling up for efficient production. That was necessary to secure the work in competition. Much of that work had to be delivered before there was time to tool up for production on the jobs. That loss of 0.6 cents a pound will be superceded by a profit as soon as the patterns are in shape for efficient production.

The 1.4 cents a pound shown as an operating loss for company *D* is caused by inaccuracies in setting standards.

Finally let us compare the managerial value of this report with a commonly used profit report, shown in the accompanying table. This type of profit and loss report, prepared semiannually, is not as effective as reports prepared monthly in the form shown in Fig. 1 because:—

1—Management waits too long
2—It does not designate the profitable and unprofitable customers
3—It does not place responsibility for profits and losses as between market sales conditions and operating efficiency
4—It does not permit quick comparisons:
- (a)—Each month with budget
- (b)—One month with another
- (c)—One customer with another
- (d)—Cumulative monthly totals of all elements entering into the calculations of profits and losses.

PROFIT and LOSS REPORT

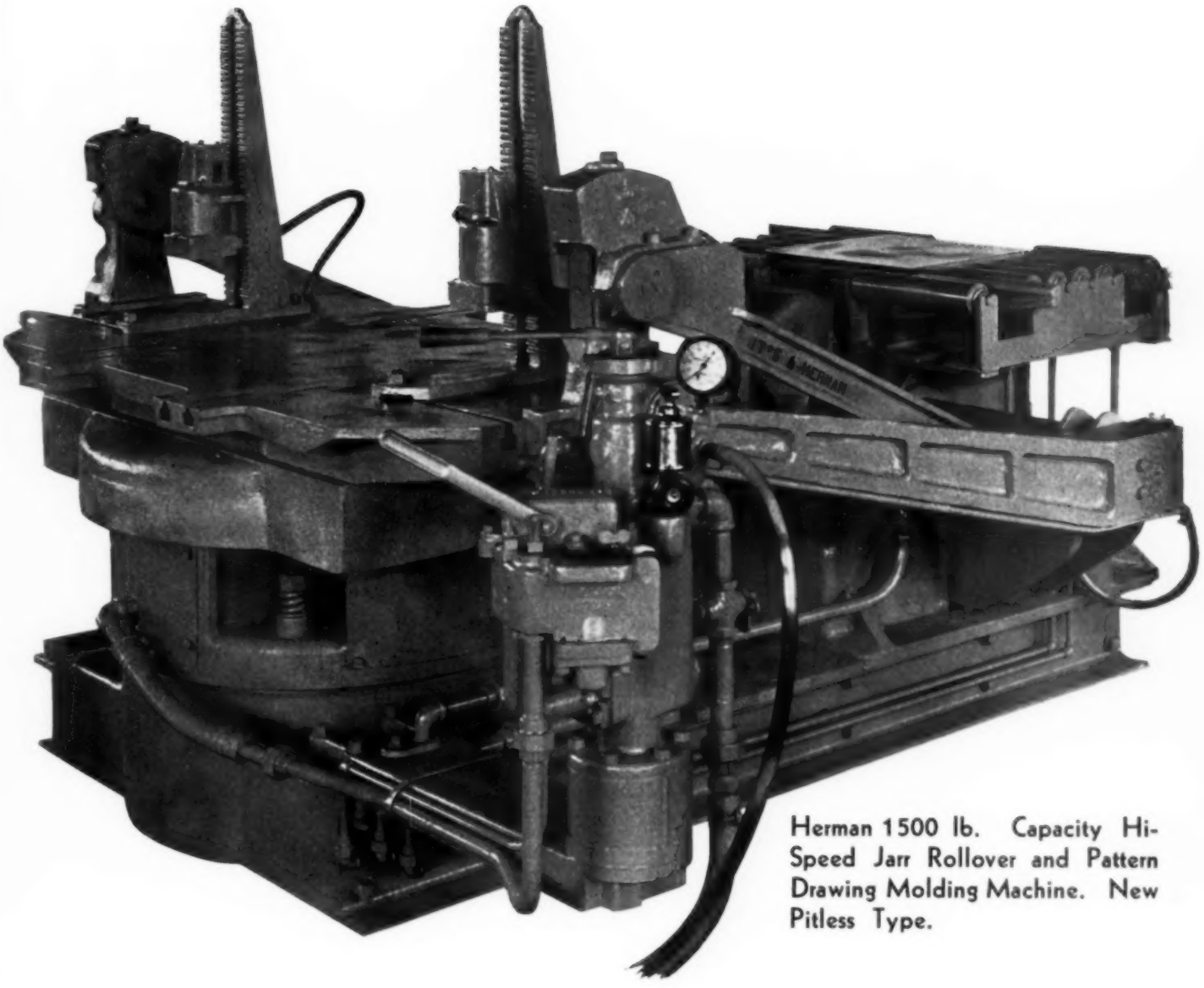
GROSS SALES						
Less deductions					124,030	
NET SALES					4,302	
					119,728	100%
COST OF SALES						
INVENTORY AT BEGINNING				20,810	17%	
METALS PURCHASED				27,464	23.2%	
DIRECT LABOR				32,881	27.6%	
OVERHEAD EXPENSES						
Indirect labor	15,280	12.8%				
Clerical	1,668	1.4%				
Superintendent	2,708	2.3%				
Supplies	13,504	11.3%				
Repair buildings	77	0.1%				
Repair equipment	1,045	0.9%				
Insurance	636	0.5%				
Depreciation	3,666	3.1%				
Heating expense	406	0.4%				
Power and light	2,570	2.2%				
Gen'l plant expense	1,648	1.4%				
Compensation ins.	1,432	0.9%		44,640	37.3%	
				125,795	105.1%	
INVENTORY AT CLOSE				23,565	19.7%	102,230 85.4%
GROSS PROFIT						17,498 14.6%
SELLING AND ADMINISTRATIVE EXPENSES						
Officers' salaries				5,850	4.9%	
Licenses and fees				1,472	1.2%	
General expenses				402	0.3%	
Stationery and equipment				111	0.1%	
Telephone and telegraph				252	0.2%	
Donations				134	0.1%	
Dues and association expenses				236	0.2%	
Interest cost				199	0.2%	
Loss on bad debts				1,500	1.3%	
Traveling expense				254	0.2%	
Advertising				304	0.2%	10,714 8.9%
NET PROFIT						6,784 5.7%

Moves Warehouse

Portland, Oregon warehouse of the Link-Belt Co., has been moved to the corner of Fourteenth avenue and Savier street.

The Fourth International Heating and Ventilating exposition will be held in Chicago at the new International Amphitheatre, Jan. 27-31, 1936.

IT'S A HERMAN



Herman 1500 lb. Capacity Hi-Speed Jarr Rollover and Pattern Drawing Molding Machine. New Pitless Type.

This is the machine to use when accurate molds and cores must be obtained. Modern foundrymen everywhere appreciate its speed, its construction, its operation. Properly served, equipped with automatic air clamps, fluid timing valve and gravity rolls, it is giving complete satisfaction in all classes of foundries.

Write for Descriptive Literature

HERMAN PNEUMATIC MACHINE COMPANY

General Offices: Union Bank Bldg., Pittsburgh, Pa. Plant: Zelienople, Pa.

Birmingham Engineers And Foundrymen Meet

Unusual interest featured the third joint foundry practice meeting held at Birmingham, Ala., Feb. 28 and March 1 under the auspices of the Birmingham section of the American Society of Mechanical Engineers and the American Foundrymen's association. In excess of 200 registered for the meeting. At the technical session on Thursday morning, J. S. Vanick, International Nickel Co., New York, presented a paper on "Alloyed Iron in Southern Industrial Fields." The speaker pointed to the production of pressure castings in southern shops and then discussed the effects of alloy additions upon the properties of that class of casting, including hardening, wear resistance, abrasive resistance, high strength, toughness, impact, temperature resistance and corrosion resistance.

At the luncheon meeting on Thursday, B. H. Johnson, assistant to the president, R. D. Wood & Co., Philadelphia, and vice president of the American Foundrymen's association, spoke on "Association Possibilities with Special Reference to the A.F.A." Mr. Johnson pointed to the splendid service which has been rendered the foundry industry by the A.F.A. through its convention work, various committees, its joint activities with other associations, and its many other functions. Mr. Johnson also outlined the benefits to be derived by foundrymen in various districts through the establishment of local chapters of the A.F.A., and pointed to the splendid accomplishments of the Chicago group during the past year.

At the afternoon technical session, George S. Evans, metallurgist, Mathieson Alkali Works, New York, presented an interesting paper on "Two Applications of Soda Ash in Foundry Practice." Mr. Evans explained the chemistry of cupola melting and then discussed how soda ash may be used either in the cupola along with the limestone, or employed in a forehearth or teapot ladle. A second paper at the afternoon session was presented by S. D. Moxley, chief engineer, American Cast Iron Pipe Co., Birmingham, on "Dust Collection in the Foundry." Mr. Moxley pointed out that each dust problem is particular in itself and that there is a particular type of equipment which is best suited for the individual job. It is for the engineer and the foundryman to analyze properly the problem, and to ascertain the degree of fineness of dust to be collected before attempting to select the type of equipment. The speaker described several types of collecting equipment. Following the afternoon session, an open house and entertainment was provided with Joseph W. Eshelman, James L. McVoy, Russell Hunt, William Oberhelman, T. H. Benners Jr., Kenneth Mann and Jack Hayes acting as hosts.

Friday morning was devoted to visiting a number of plants in the Birmingham district. The technical session on Friday afternoon featured two papers, on "Conditioning of Foundry Sand," by William L. Hartley, technical engineer, Link-Belt Co., Chicago, which was read by R. J. Heisserman, also of that company, and the second, "Soft Metal and Safe Sand for Soil Pipe," was presented by J. M. Franklin, assistant foundry superintendent, Central Foundry Co., Holt, Ala. Mr. Hartley's paper discussed the problems which must be taken into consideration in determining the proper procedure for preparing molding sand. Mr. Franklin discussed the type of iron needed for soil pipe and brought out the fact that the method and manner of producing pig iron has more to do with the nature of the product than is shown by the amount or percentage of alloys revealed in the chemical analysis. At the same time he stressed the point that sound cupola practice is necessary if the casting is to be satisfactory. The speaker also pointed to the sand deposits which are available in the vicinity and then discussed the properties needed in sand for producing soil pipe.

The annual banquet was held Friday evening at the Tutwiler hotel, with Karl Landgrebe as toastmaster, and J. A. Sirnit, presiding. Harry N. Clarke, Council on Industrial Morale, Cleveland, spoke on "Men-Money-Management."

New England Meeting Features Housekeeping

Dr. Albert S. Gray, bureau of occupational diseases for the state of Connecticut, spoke at a meeting of the New England Foundrymen's association on March 13 at the Engineers club, Boston. George W. Thornburg, president of the association presided. Dr. Gray spoke on "Silicosis in the Foundry Industry". At the conclusion of his talk, A. B. Root Jr. called on a number of members present to discuss the work which they are doing in connection with the good plant housekeeping. Among those contributing to the discussion were the following: E. R. Prince, formerly manager of the Framingham Foundries, Inc., Framingham, Mass.; LeRoy Sherwin, superintendent, Brown & Sharpe Mfg. Co., Providence, R. I.; Dr. Schumahle, General Electric Co., Lynn, Mass. and Mr. Root, Hunt-Spiller Mfg. Corp., Boston.

Gray Iron Foundry Industry To Meet in June

Henry M. Halsted, Jr., executive vice president, Gray Iron Founders' society and national code authority for the gray iron foundry industry has announced an industry meeting to be held, Thursday and Friday, June 6 and 7 at the Hotel Gibson, Cincinnati.

Six committees have been appointed and it is expected that the final program will take form rapidly. It is anticipated that the first day will be devoted to outstanding industry questions. A paper will be read on each question, followed by floor discussion. These papers will deal with such subjects as costs and cost accounting; merchandising, industrial diseases, published prices, etc. Also on the first day there will be a noon luncheon and an evening banquet, with speakers and entertainment. The second day will probably be devoted to a business meeting at which the members of the national code authority and the board of directors of the association will be elected, and numerous meetings of supplemental groups.

A large attendance of gray iron foundrymen is anticipated and special arrangements are being made to provide entertainment for the ladies.

Quad Cities To Form Local Chapter of A.F.A.

Clyde Burgston, Deere & Co., Moline, Ill., president of the Quad-City Foundrymen's association, announced at a meeting of that group held at the Le Claire hotel, Moline on March 18, that the board of directors of the association had decided to affiliate with the American Foundrymen's association by establishing a local chapter of that organization. The general plan of the local chapter was explained briefly and a committee was appointed to nominate officers and report at the next meeting.

R. C. Good, Electrometallurgical Co., Pittsburgh, presented an interesting talk on "Steel Castings and Quality Control". Mr. Good stressed the importance of proper melting and discussed several types of melting units.

Plan Japanese Show

A metals industry exposition is being promoted jointly by Agne (*The Journal of Metals*) and The Nikkan Kogyo Shinbun-sha (*The Daily Industrial News*) to be held in Osaka, Japan, May 10 to 31, 1935. These Japanese publications are soliciting exhibits of equipment and machinery from the United States.

ADVERTISING PAGES REMOVED

The old jokes never grow stale

The Adventures of Bill

BY PAT DWYER

WHAT would you think," Bill inquired one night recently, "what would you think if I told you that I now am in possession of a priceless recipe which without the slightest peradventure of doubt will make me a fortune?"

"Before committing myself to a definite expression of opinion on such a momentous subject," I admitted cautiously, "I should like to have a few further details. For example, did this highly gratifying recipe come into your possession on or about April 1? Of course I may be all wrong, and I may be doing you a gross injustice in harboring even a vagrant hint of suspicion, but a fortune teller once warned me that the milk of human kindness is at the lowest ebb on that day. Presumably this recipe is the invention of a second party, name at present unknown to your humble & obt. servant. The question therefore arises, did this party of the second part exchange this recipe for valuble consideration, to wit: One dollar in hand, well and truly paid, or, did he, she, or it bestow the aforesaid priceless recipe as a gift? If the old memory serves me correctly, the Greeks, who seem to have a name for everything, inaugurated the custom of presenting surprise gifts on April 1. Unfortunately, I do not circulate as promiscuously as I did at an earlier age, but occasionally my attention is directed to the fact that the gyppers and practical jokers still celebrate their favorite anniversary in a manner that does them no credit. In the second place"—

"In the second place," Bill interrupted, "also in the third, fourth, fifth and as many more as you care to mention, you had better give 'er the sand. Your drivers are whirling, but you ain't gettin' no place. If you will be kind enough to side-track that mental derelict of yours and let me have the main line I'll let you have the inside dope on this here proposition. April 1 is out. So are fortune tellers, the Greeks, the parties of the first and the second part, and—boo to you—the humble and obt. servant. Where do you get all that tripe? I ask you a plain, simple, civil question. Instead of answering yes or no like an officer and a gentleman—within your limitations—you squat there and ooze drivel like an over-ripe tammata—"

"A tomato, eh? Have you been sitting up in the gallery watching Shawn Casey's latest play?"

"Who, me? Not likely. The comparison to a tammata, if I do say it myself, was just one of these happy inspirations. I might do better if I had time to devote to a serious consideration of the subject, but in the meantime it will serve. 'Pon my word, on account of your constant and piffly interruptions I have a mind to tell you nothing further about the recipe. Serve you right to let you stew in your own juice and die miserably of thwarted curiosity."

"Suits me," I said with a fine assumption of carelessness. "I probably have heard the story before. Which one is it this time, the Spanish prisoner, the chart with the skull and cross-bones marking the location of the treasure chest, the secret of extracting radium from the radii of the outer and inner circles, or a plan to monopolize the dairy business of the world by running a pipe line to the Milky Way?"

The young jokes also are funny

"You may have heard these stories before. They are new to me and I would not care to venture an opinion on their merits without further study. However, this recipe which came into my hands a short time ago is connected with the foundry industry. I have not tried it yet, but I am going to give it a whirl one of these fine days. The most amazing feature about it is that it was discovered by a man with absolutely no knowledge of the foundry. Perhaps I should qualify that statement. Apparently he is aware of the fact that castings are made in a foundry and the further fact some of them are hauled away on railroad cars and delivered to customers."

"Do you mean to tell me that a man who knows nothing whatever of foundry technique, materials, methods, processes, has discovered a recipe for making money in this highly technical, delicate and precarious business?"

"Sure," Bill assured me blandly. "Why not? If he knew anything about the subject, the hazards, the pitfalls and the infinite variety of variable factors, he would stay in his shell instead of exposing himself to ridicule. As it is he boldly rushes into print. Presumably he was paid for his effort, a rather melancholy comment on the capability of the editor who accepted the stuff, the same kind of stuff, by the way that is used in other industries to inflate balloons and pneumatic mattresses."

"Just a moment, dear lad. Let's get this thing straightened out. Am I to understand that the originator of the recipe tried it out and made—let us say—gobs of money, or simply invented the thing and then described the various sterling advantages? Seems to me there is a proverb or something about an extremely hazardous area bounded at one end by the cup and at the other end by the lip. If the recipe worked for him, it may or may not have merit. If it is still in the work-

shop awaiting a practical road test, why—to modernize the old simile—that is a car with an altogether different type of bonnet."

"Well," said Bill, "I'll tell you. This particular item does not fall into either classification. The hero—and I use the word advisedy, since a bird who claims familiarity with a subject of which he knows nothing, is a hero of some kind—the hero who wrote the article does not claim that he either originated or applied the idea. He simply—"

"Ah! He had a dream. That clears everything up nicely. Proceed."

"Say! Lissen. Who's telling this thing, you or me?"

Amazing discovery by young sleuth astounds veteran foundrymen

"Search me. I know I am not telling it and from the progress you have made up to the present I should hate to commit myself to a statement that you are telling me anything. Suppose we assume that it must be two other fellows from Pittsburgh who are involved, call all bets off and let it go at that."

"So you see fit to scoff, hey? Well, scoff away, my lad. 'Tis ever the way of the proletariat to cock an eye and curl a lip at anything above or outside their comprehension. Original ideas of any kind always are hailed with scorn by the mentally sterile and impotent. Here's a lad who describes a method of making money in the foundry, a method which to my certain knowledge never has been tried, and which never has been even thought of by any person engaged in the industry. Instead of listening carefully and probably profiting thereby, you stick on your high hat, twirl your cane and grandly intimate that you are not even remotely interested. I just can't decide in my own mind whether you simply are indifferent, plain lazy or too dumb to rise to the occasion."

"I think you would be quite safe in setting my attitude down to a combination of all three. Mind you, this is not to be taken as admission that I accept your diagnosis as correct. It simply is a courteous gesture on my part to indicate that you are quite welcome to your own opinion. If I can be of ny further service to you, my dear sir, why, come up and see me sometime. Your very truly, etc."

"Thank you very kindly for such a cordial invitation. I was beginning to think that perhaps the subject did not appeal to you and for that reason I was rather diffident about introducing it. However, now that you evince such a burning curiosity to learn all the details I can proceed with a clear conscience."

"Clear what?"

"Conscience. Conscience—don't you know what a conscience is?"

"Certainly. That is the reason I asked the question!"

"Meanin', Suh? Well, let it go. Some day when I have more time I shall take a fall or two out of you on this conscience thing. In the meantime, since you are sizzling with impatience and curiosity—there, there, my boy, not a word—I can see it in your eye—since, as I say, you are fairly bursting with restrained desire to know all, I shall tell you the story of the Boy Who Made Good in a Big Way."

"I hope this is not a warmed over edition of the story concerning the boy, the bag of dried apples and the old oaken bucket that hung in the well. If it is, you can save yourself the trouble—"

"Well," said Bill, "I'll tell you. If you examine the story closely you may be able to detect a slight flavor of apple sauce. Otherwise, there is no resemblance or relationship to the hoary veteran you have in mind. This story is modern, right up to the minute and shows what a resourceful, ambitious young lad can do after a cruel employer drops him from the payroll. The author of the article detailed the activities of several people forced by circumstances during the past four years to seek new connections. In every instance they came through with flying colors and secured positions much more dignified, important and lucrative than those they held before. The touch of a single magic idea, and lo, overnight they developed from little shots into big shots. The magic formula in every instance was to approach a big business man. Show him a method for making a large sum of money and immediately he would fall on your neck, invite you to take a place on the executive staff and name your own salary.

"The article was titled *Ideas Get the Job*. I was not particularly interested in the case history of various individuals who applied the magic formula in various sections of the commercial and industrial fields, but the last example certainly made an impression. In this instance an earnest young seeker of the light discovered a large and gaping hole in the old sock where a foundryman kept his money. He modestly directed the foundryman's attention to the fact that a large quantity of real coin oozed through this hole every year. Also, and more important, he showed him how to plug this hole. Here, I'll read you the exact words:

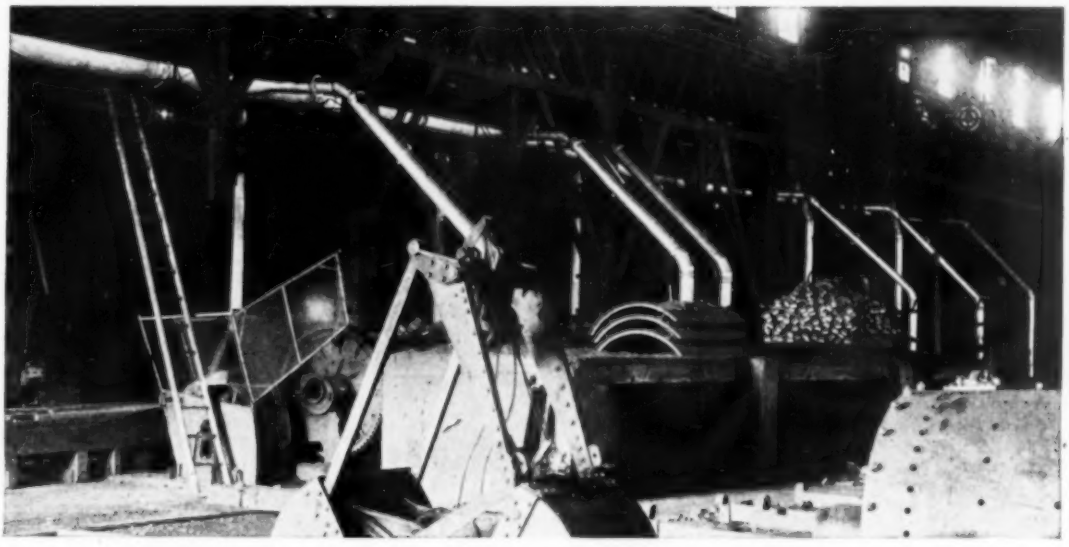
Then there was the young shipping clerk who lost his job in a railroad office. He remembered a certain large steel company that had been kicking to the road about discrepancies in the weight of the castings they manufactured and the high rate charged for freight. Playing a hunch he investigated in the factory, discovering as he expected—

"Listen carefully now," Bill said. "This probably is one of the most important features ever discovered in steel foundry practice. As with many other discoveries and inventions it was brought to light by an outsider."

—discovering as he expected, that the molds in which the metal was cast had become worn and enlarged over a period of years so that more metal was used than formerly. Hence the catalog weight did not agree with the actual weights by which they were charged. He went to the sales manager of the company with the facts carefully worked out and showed how thousands of dollars a year in freight charges and in wasted metal could be saved. Then he asked for a job. No job was available, but one was created.

"What kind of a job do you suppose they gave him?" I asked Bill.

"What kind of a job? Why, that's easy. They gave him a life-time job designing a sand mold that could be used for years and years and years. Something to take the place of the present woefully inadequate sand molds which increased in size after only a few years' service."



Removing dust from a row of tumbling mills, using extra heavy gauge piping

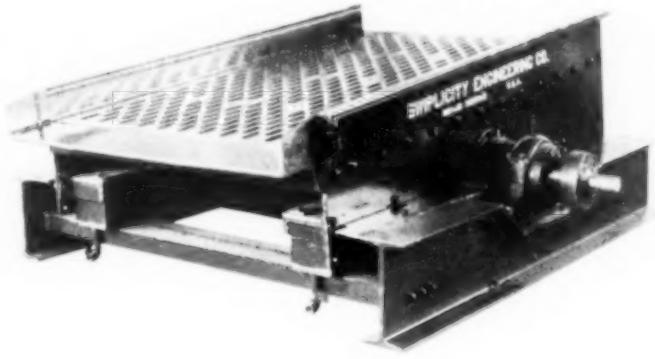
K & B Systems *Economically* Remove Dust Hazard

Dust conditions in your plant represent an individual engineering problem which Kirk & Blum equipment and service will definitely solve.
Before you repair or replace your present dust collecting system, let our engineers advise you, without obligation, how to get maximum efficiency with lowest operating cost. Write

KIRK & BLUM
Dust Collecting Systems

THE KIRK & BLUM MFG. CO.,
2808 Spring Grove Ave., Cincinnati, Ohio
Detroit Factory and Office: 4718 Burlingame
Chicago Office: 3843 N. Central Park Ave.
Pittsburgh Representative:
Bushnell Machy. Co., 1501 Grant Bldg.
Louisville Representative:
Liberty Blow Pipe Co., Inc., 325 Roland St.

Simplicity Shake-Out Units



Are Now Shaking Out

Flasks and Castings at the rate of 500 Molds per hour; Cores from Engine Blocks; and in a Steel Foundry, Baked Dry Sand Molds, some weighing 1000 pounds, in a Small Fraction of the Time previously required. Cleaner Castings are produced and Costly Shutdowns Eliminated with greatly Reduced Operating Expense.

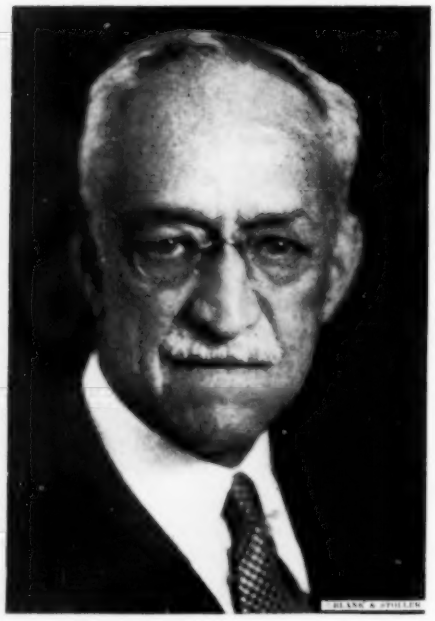
Continuous service under severe conditions with these results are bringing Repeat Orders. One company has just placed its 9th order making a total of 17 Simplicity machines for this foundry. There is the proper size of Simplicity Shake-out, Casting Conveyor and Sand Screen to produce these vitally important results in your own foundry. Portable Shake-Outs and Portable Sand Screens with attached Aerators, are available for use where needed. Results guaranteed.

For Information Write

Simplicity Engineering Company

Durand, Michigan

For Canada: Waterous Limited, Brantford, Ontario



J. H. Whiting, Pioneer Foundry Equipment Manufacturer, Dies

JOHN HILL WHITING, chairman of the board, Whiting Corp., Harvey, Ill., died at his home, April 6. This marks the passing of a pioneer figure, a patriarch in the industry, who for more than 50 years was associated directly or in a parallel interest with castings manufacture. Starting as a foundryman, he developed from first-hand knowledge the concept that the industry required cost-reducing equipment and made the manufacturing of the latter his life work.

Mr. Whiting was born at Sault Ste. Marie, Mich., Oct. 11, 1850. He started as a clerk in the foundry of the Michigan Car Co., Detroit, and that quality of tireless energy and alertness which distinguished him in the mind of his associates of that day, constituting him a veritable human dynamo, led to his rapid advancement until he was general superintendent of the plant. He developed short cuts and improvements in the manufacture of car wheels and was one of the earliest to appreciate the economy of straight line manufacture. His patents on straight line production principles closely approximate the basic ideas of present automotive manufacturing methods.

Mr. Whiting's interest in cupolas and other foundry equipment led to the establishment of a company to manufacture and build that type of equipment on a commercial scale. Starting with ladles, cupolas, tumbling mills, elevators, traveling cranes, etc., the business grew and developed and in 1894 was removed from Detroit to Harvey, Ill., under the name of the Whiting Foundry Equipment Co. Later many additional lines of manufacture and special types of machinery were developed prior to the celebration of the Golden Anniversary of the company in 1934.

From his early days Mr. Whiting was interested in the furtherance of foundry education and the interchange of technical information. He took a generous interest and showed marked encouragement to John A. Penton in his establishment of THE FOUNDRY in 1892. He was a member of the group who comprised the first gathering of foundrymen at the formulation of the American Foundrymen's association in Philadelphia in 1896.

The continuation of the latter interest was further shown when in October, 1920, he contributed a sum of $5000 to the American Foundrymen's association, the proceeds of which have been used to establish awards of the J. H. Whiting medal for contributions in foundry practice. Recipients of this award have been the following: John Howe Hall, E. V. Ronceray, Ralph MacPherran, and Arnold Lenz.

In addition to his activity in the American Foundrymen's association, Mr. Whiting was identified with many trade, industrial, and social organizations.

He is survived by his widow, Mrs. Caroline F. Whiting; one son, Bradford Hill Whiting of Cincinnati; three daughters; Mrs. R. E. Prussing of Chicago, Mrs. T. S. Hammond of Flossmoor, Ill., and Mrs. Jesse Spalding of New York City; also 11 grandchildren and two great grandchildren.

Obituary

EDGAR C. DAVIDSON, who has been identified with the Safety First Shoe Co., Holliston, Mass., for the past 27 years, for the major portion of which time he was active in improvement and promotion of this type of safety device, died at his home at that city, March 23.

Mr. Davidson was born in Natick, R. I., in 1878, and resided during the greater portion of his life in Providence. In addition to his association with foundry and business associations, he was a member of a number of Eastern clubs and fraternal organizations.

♦ ♦ ♦

Joel S. Coffin, 74, chairman, Lima Locomotive Works, Lima, O., died March 11.

♦ ♦ ♦

Louis H. Burkhart, 60, chief engineer, Struthers - Wells - Titusville Corp., since 1897, died in Pittsburgh, March 5.

♦ ♦ ♦

Herbert Charles Baldry, 49, vice president, Flour City Ornamental Iron Co., Minneapolis, died in Minneapolis on March 9.

♦ ♦ ♦

John T. Seaman, 57, president, Sea-Thor Brass Foundry Co., Milwaukee, died recently from injuries received in an automobile accident.

♦ ♦ ♦

Charles L. Buss, 65, for many years connected with the Dent Hardware Co., Fullerton, Pa., died recently at his home near Wescosville, Pa.

♦ ♦ ♦

William S. Elliott, 72, president, Elliott Co., Pittsburgh, died recently. In 1904 Mr. Elliott founded the Liberty Co. and later expanded it forming the Elliott Co.

♦ ♦ ♦

James F. Leahy, 65, general superintendent, Buffalo plant of the Farrel-Birmingham Co. Inc., died at his home in Kenmore, N. Y. March 6. Mr. Leahy was born in Torrington, Conn. Oct. 23, 1870 and resided in Ansonia, Conn. for 22 years. He had been employed by the Farrel-Birmingham Co. since Dec. 2, 1901.

♦ ♦ ♦

John E. Fisher, 69, for many years connected with the foundry industry, died recently at his home in Lima, O. Mr. Fisher was born in Yorkshire,

MODERN
Pouring Devices

are an absolute foundry essential for production under NRA conditions!

Here is one man handling an 800 pound ladle of *malleable iron* without assistance, with a pouring capacity of 4 to 5 tons an hour. Modern Pouring Equipment makes the job easy for him—the Modern Ladle Insulation and Cover protects him from the heat and gases of the ladle—and the Modern Geared Ladle with a self-locking worm gearing, makes the job absolutely safe for him.

Provide for this type of equipment before the hot weather sets in this year. Let Modern engineers show you how an inexpensive Modern system will turn back its cost to you in a very short time, and enable you to better control your production schedules.

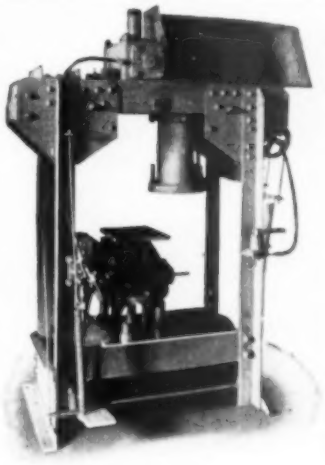
MODERN
Geared Ladles
Metal Pouring Systems
Crane & Monorail Systems
Sand Conditioning Systems

Patented & Patents Pending

MODERN EQUIPMENT CO.
PORT WASHINGTON, WIS.
Dept. 110

"CERTIFIED"
STEEL
ABRASIVES
The World's Best Abrasives for all Blast Cleaning.
As sharp as a diamond ... as hard as a hammer.
Does the job quickly, efficiently and dustlessly. A size to fit every need.
Use it NOW
GRIT AND SHOT
PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PENNA.
STEEL SHOT AND GRIT CO.
BOSTON, MASS.

Auto Malleables
Plumbing Goods
Stove Burners
Manifolds
Pipe Fittings
Vacuum Cleaners
Condulets
Carburetors
Specialties



Cores for the above castings are being made universally on our machines, resulting in greatly increased production and better cores.

We have a machine for your job.

Your Correspondence Solicited

Wm. Demmler & Bros.
Kewanee, Illinois

England, and served his apprenticeship under his father in Corry, Pa. Later he became superintendent of the National Transit Co., Oil City, Pa. Mr. Fisher educated himself to be a chemist and was the inventor of the Fisher steel converter. Since 1910 he was employed by the Ohio Steel Foundry Co., Lima, O.

♦ ♦ ♦

Bayard T. Bacon, 80, prominent in the pig iron business in Chicago until his retirement from Pickands, Brown & Co. in 1925, died at Oak Park, Ill., recently.

♦ ♦ ♦

F. C. Thompson, 51, vice president and general manager, Morse Chain Co., Ithaca, N. Y., and Detroit, died March 6. Mr. Thompson had been active in the automotive industry for 32 years.

♦ ♦ ♦

J. M. Eastham, 71, president, Rudisill Foundry Co., Anniston, Ala., died at Sarasota, Fla., March 13. For many years Mr. Eastham had been connected prominently with financial and industrial interests in Anniston.

♦ ♦ ♦

Frank L. Morse, 70, president, Morse Chain Co., Ithaca, N. Y., died in Orlando, Fla., March 25. Mr. Morse remained as president of the Morse Chain when it was taken over by the Borg-Warner Corp., Chicago, in 1929.

♦ ♦ ♦

Ralph H. Clore, general sales manager, the Medart Co., St. Louis, died March 6. Mr. Clore occupied that position only a short time having previously been general sales manager, United States Electric Tool Co., Cincinnati.

♦ ♦ ♦

Franklin C. Hockensmith, 81, founder and former president of the Hockensmith Wheel & Mine Car Co., Penn, Pa., died at Los Angeles, March 10. He was born in Greencastle, Pa., later lived in Pittsburgh, but had lived in Los Angeles since his retirement in 1915.

♦ ♦ ♦

Charles A. Adams, 39, a director and plant superintendent, Mathews Conveyor Co., Ellwood City, Pa., died March 23. Mr. Adams had been an employe of that company since 1912, filling key positions in both manufacturing and engineering departments.

♦ ♦ ♦

William R. O'Donovan, superintendent, foundry department, Homestead works of the Carnegie Steel Co., Pittsburgh, died March 18. Mr. O'Donovan had been connected with the Homestead Steel Works for 43 years and during the past 12 years had been in charge of the foundry department.

♦ ♦ ♦

William H. Moulds, 61, owner of the Moulds Brass Foundry, Benton Harbor, Mich., died recently. Mr. Moulds was born in Iron Ridge, Wis. in 1873 and had been connected with the foundry business for the past 37 years. He went to Benton Harbor in 1892.

A. S. T. M. Committees Meet in Philadelphia

Numerous committees of the American Society for Testing Materials met in Philadelphia the week of March 4 to 8 in connection with the regional meeting of the society on March 6 which featured a symposium on paint and paint materials. A large number of proposed standards were offered by the committees and several specifications and test methods, which have been in the tentative stage, were recommended for adoption as standards. Several new committees will be organized as the result of action taken by the standing committees in an endeavor to undertake research for other types of work.

Criticism was raised at a meeting of committee A-1 on steel concerning certain requirements in the tentative specifications for carbon steel castings for industrial, railroad and marine uses (A-154-33T), which it was thought would replace eventually the standard specifications for carbon steel castings (A 27-24) and for carbon steel castings for railroads (A 87-27). It was decided to recommend the withdrawal of A 154 the standards A 27 and A 87 being still in effect. A sub-committee will prepare drafts of specifications to cover separately different grades of carbon steel castings, including castings made of steel suitable for welded structures.

A combined meeting of sub-committees on chemical analysis, of several of the A.S.T.M. committees dealing with ferrous metals, resulted in the approval of the formation of a new standing committee to cover chemical analysis of metals. Extensive proposed revisions in the chemical determination of carbon, manganese, copper, sulphur and silicon were reviewed and submission of these to the society is anticipated shortly as soon as minor items can be worked up. This work anticipates the consolidation of A.S.T.M. methods of analysis of ferrous metals into one specification.

Committee A-3 on cast iron recommended actions on a number of specifications. Revisions are being recommended on tentative specifications for gray iron castings (A 48-32T). The separately cast tensile bar will be eliminated since tests have shown that tensile bars cut from the transverse test bars are satisfactory. Transverse test values will be revised. A proposed tentative specifications for automotive gray iron castings has been developed with the cooperation of the iron and steel division of the Society of Automotive Engineers. Another activity involves necessary revisions in the existing specifications for cast iron culvert pipe (A 142-34T).

Committee B-5 on copper and copper alloys, cast and wrought, is continuing its extensive standardization work and has proposed new tentative specifications covering phosphor-bronze bearings and expansion plates for bridges and structures, and silicon-bronze bearings and plates for the same purpose.

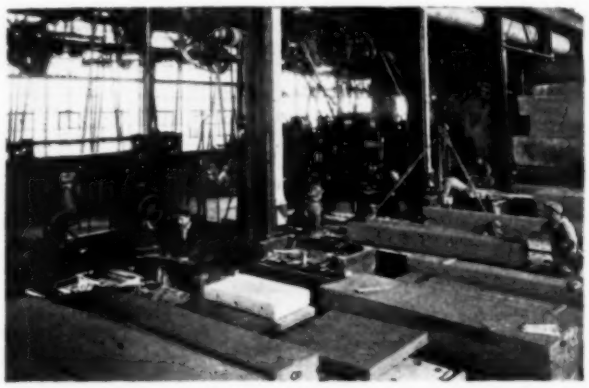
Revised methods for preparing and examining specimens were considered by the committee on selection and preparation of samples for metallographic testing. The first section of the proposed standard covers selecting, mounting and cleaning of samples. This is followed by discussion of recommended procedures for examining the various metals and their alloys including aluminum, copper, iron and steel, lead, magnesium, nickel, precious metals, tin, zinc, and finally recommendations covering microscopy and photography.

A new committee on properties of metals at low temperatures was organized as a subcommittee of the joint committee of the effect of temperatures on the properties of metals. For the purpose of the work, the committee has defined low temperatures as 70 degrees Fahr.

Supports Steel Code In Brief to Congress

The Steel Founders' Society of America has presented to Congress a brief presented by Merrill G. Baker, executive vice president, affirming the benefits experienced by the industry through the operation of its NRA code. Colonel Baker summarized the increases in employment and wages, the stabilization, by moderate price advance due to its price reporting plan, the benefit of complete and accurate statistics, improvement in cost practices and the general influence on the morale of the industry.

In summarizing, Colonel Baker emphasizes the points that the price control provision of the Steel Founders' code is not price fixing, that it operates merely as a control on prices tending toward fairness and uniformity, that it improves competition and in no means operates to limit or oppress small industry.



BUCKEYE
SILICA FIRESTONE

Can be used in . . . . .

7 *different ways!*

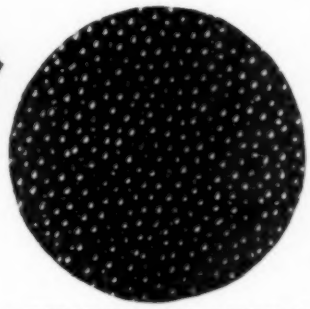
DO YOU KNOW THEM?

Send for Literature

The Cleveland Quarries Company

1125 Builders Exchange Bldg.
CLEVELAND, OHIO

AMERICAN
CHILLED STEEL ABRASIVES



"EVERSHARP" STEEL GRIT

Accurately graded to 10 sizes. Excellent for cleaning surfaces to be enameled or painted.

"STANDARDIZED" STEEL SHOT

Graded evenly to 16 standard sizes. Extremely hard and lasting for all blast-abrasive work.

American Steel Abrasives are Blast abrasives at their best. Their use means Lower Cost, Faster work and *Better* work.

Write us for samples and prices on these better Abrasives.

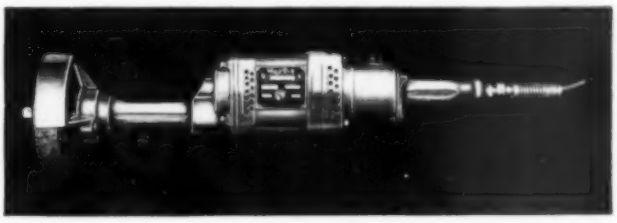
The American Steel Abrasives Co.
Galion, Ohio

CP GRINDERS
do the job FASTER!
BETTER!
CHEAPER!

● "POWER VANE" ROTARY TYPE

A series of four vanes rotating on a spindle in a casing having suitable openings for the admission and escape of compressed air . . . is the simple principle embodied in CP "Power Vane" Rotary Grinders. No pistons. No toggles. No crankshaft. A minimum of parts, hence a minimum cost of operation and maintenance. Simplicity of construction, yes . . . yet these modern tools develop *more power per pound of weight than any other pneumatic tools of equal capacity!*

Light in weight, perfectly balanced, governor-controlled, vibrationless, there is a size and type for turning out *your* grinding jobs faster, better and cheaper. Details, or demonstration, on request.



● Hicycle ELECTRIC

Operation on high frequency current gives Hicycle Electric Grinders far greater speed and power than ordinary electric tools. Further, that greater speed is held practically *constant under all loads.* Records show that Hicycle Grinders turn out *at least* 25% more work . . . that surfaces of *uniform* smoothness are obtained . . . that abrasive wheels have *at least* 25% longer life . . . that maintenance is *at least* 50% lower.

Available in sizes and types for all classes of grinding, smoothing and cleaning, Hicycle Grinders offer you a real opportunity to effect real savings. Facts and figures are available for the asking.

CHICAGO PNEUMATIC TOOL CO.
6 EAST 44th STREET **NEW YORK, N. Y.**

Manufacturers of

AIR & GAS COMPRESSORS
ROCK DRILLS
DIESEL ENGINES
ELECTRIC TOOLS
PNEUMATIC TOOLS
VACUUM PUMPS & CONDENSERS

Petition A. F. A. for Northeast Ohio Chapter

Foundrymen from northeastern Ohio met at Cleveland, Monday evening, March 25 and voted to petition the American Foundrymen's association for affiliation as a chapter in that section, to be known as the Northeastern Ohio chapter of the A. F. A.

The following officers were elected: Chairman, Walton L. Woody, foundry manager, National Malleable & Steel Castings Co., Cleveland; vice chairman, Frank G. Steinebach, managing editor of THE FOUNDRY; secretary-treasurer, R. F. Lincoln, assistant sales manager, Osborn Mfg. Co., Cleveland; directors for 1 year, R. W. Parsons, Ohio Brass Co., Mansfield, O.; Charles Seelbach, Forest City Foundries Co., Cleveland; A. C. Denison, Fulton Foundry & Machine Co., Cleveland; directors for 2 years, J. H. Bruce, Bowler Foundry Co., Cleveland; William Gluntz, Gluntz Brass & Aluminum Co., Cleveland; B. G. Parker, Youngstown Foundry & Machine Co., Youngstown, O.; directors for 3 years, Ralph H. West, West Steel Casting Co., Cleveland; R. E. Williams, Chicago Pneumatic Tool Co., Cleveland; and L. P. Robinson, Werner G. Smith Co., Cleveland.

Donald J. Reese, manager, equipment division, Whiting Corp., Harvey, Ill., and chairman of the Chicago chapter, presented an interesting talk following the dinner on the accomplishments of the Chicago group since affiliation with the national society. Dan M. Avey, editor of THE FOUNDRY, Cleveland, and president of the American Foundrymen's association, spoke briefly of the service which the association has rendered the foundry industry and pointed to the possibilities of greater foundry progress through the local chapters.

Harry W. Dietert, chief engineer, U. S. Radiator Co., Detroit, and president, Harry W. Dietert Co., Detroit, in a talk on molding sand, stressed the research carried on during the past year, and spoke specifically on the flowability, deformation, contraction and expansion of that important foundry material. Each of those factors has an effect on the resulting casting, and needs careful consideration to obtain the best results. If the sand lacks flowability, the mold surface and likewise the casting surface are not smooth. If the sand deforms easily, swells occur, and with contraction and expansion of the sand trouble is encountered with cracks in the mold surface which the iron enters or with rat-tails and scabs due to the sand being forced out from the mold face.

The next meeting of the Northeast Ohio chapter will be held in Cleveland Thursday evening April 25. Elmer Zirzow, chief chemist, Cleveland works, National Malleable & Steel Castings Co., Cleveland, will present the coffee talk, discussing practical methods of sand testing. Pat Dwyer, engineering editor of THE FOUNDRY, Cleveland, will present the principal talk of the evening on "Gates and Risers."

Holds Roundtable On Nonmetallic Fluxes

A round table discussion on "Nonmetallic Fluxes," led by David Tamor, Reading, Pratt & Cady Co., Hartford, Conn., and president, Connecticut Nonferrous Foundrymen's association, featured the regular meeting of that group held at the Hotel Garde, New Haven, March 19. Joseph T. Judge, Jenkins Bros. Co., Bridgeport, and vice president of the association, presided.

The group will hold a meeting on April 16 at the plant of the Bristol Co., Waterbury, Conn., which will feature a discussion on "Application of Precision Instruments in Foundry Practice." Raymond O'Connor, president, Contract Plating Co., Bridgeport, will address the group on May 21 on the subject "Polishing, Buffing, Dipping Acids and Finishing of Brass and Bronze Castings."

Publishes Data On Mineral Resources

The United States department of interior, bureau of mines, recently has published a statistical appendix to *Minerals Yearbook*, 1932-33. The work was prepared by O. E. Kiessling, chief economist, division of mineral statistics, bureau of mines.

The chapters of final statistics included in the volume supplement the discussion of specific mineral commodities contained in the *Minerals Yearbook*, 1932-33. Each was published separately upon completion of detailed compilation. To provide a single convenient record and reference volume containing all of the appendixes, the report has been prepared in one volume. Copies may be secured through the superintendent of documents, Washington, for $1.

Extends Trial Period

National Industrial Recovery board has announced extension of the trial period of the cost accounting system of the malleable iron industry, a schedule of fair and reasonable costs, and procedure for making such schedule effective until modified or terminated by order of the board.

Plan Symposium on Iron at Michigan State

A symposium on high test cast iron will be held at the department of mechanical engineering, Michigan State College of Agriculture and Applied Science, East Lansing, Mich., May 9 to 11 under the joint auspices of Michigan State college, the American Foundrymen's association and the Detroit Foundrymen's association. The tentative program, which has just been arranged by the general committee, contains the following interesting papers on various gray iron subjects:

Thursday, May 9

10:00 a.m. Chairman: Sherwood Bennet, Capitol Casting Co., Lansing, Mich.
Fundamental Aspects of Cast Iron, by W. H. Spencer, Sealed Power Corp., Muskegon, Mich.

2:00 p.m. Chairman: Harry Raynor, Dodge Bros, Inc., Detroit.
Superheating Cast Iron, by Frederick G. Sefing and M. F. Surls, Michigan State College, East Lansing, Mich.
Alloy Cast Irons, by E. K. Smith, Electro Metallurgical Co., Chicago.

7:00 p.m. Chairman: Jesse D. Stoddard, Detroit Testing Laboratories, Detroit
X-Ray Inspection.
Spectroscopy, by Dr. E. J. Martin, General Motors Research Laboratory, Detroit.

Friday, May 10

9:00 a.m. Chairman: Vaughn Reid, City Pattern Works, Detroit.
Practical Aspects of Founding High Test Cast Iron, by W. R. Jennings, Ecorse Foundry Co., Ecorse, Mich. Written discussion by Harry W. Dietert, U. S. Radiator Co., Detroit.

2:00 p.m. Chairman: Glenn Coley, Detroit Edison Co., Detroit.
Heat Treating Cast Iron, by H. Bornstein, Deere & Co., Moline, Ill.

6:30 p.m. Banquet. Toastmaster: Fred Erb, Eaton-Erb Foundry Co., Vassar, Mich.

Saturday, May 11

9:00 a.m. Chairman: Carl Harmon, Chevrolet Foundry, Saginaw, Mich.
Mechanics of Cast Iron, by J. W. Bolton, Lunkenheimer Co., Cincinnati.
The Foundry of 1950, by F. J. Walls, International Nickel Co., New York.

A registration fee of $3 will include a ticket to the banquet on Friday evening. All questions concerning the course should be addressed to Professor Frederick G. Sefing, mechanical engineering department, Michigan State college, East Lansing, Mich.

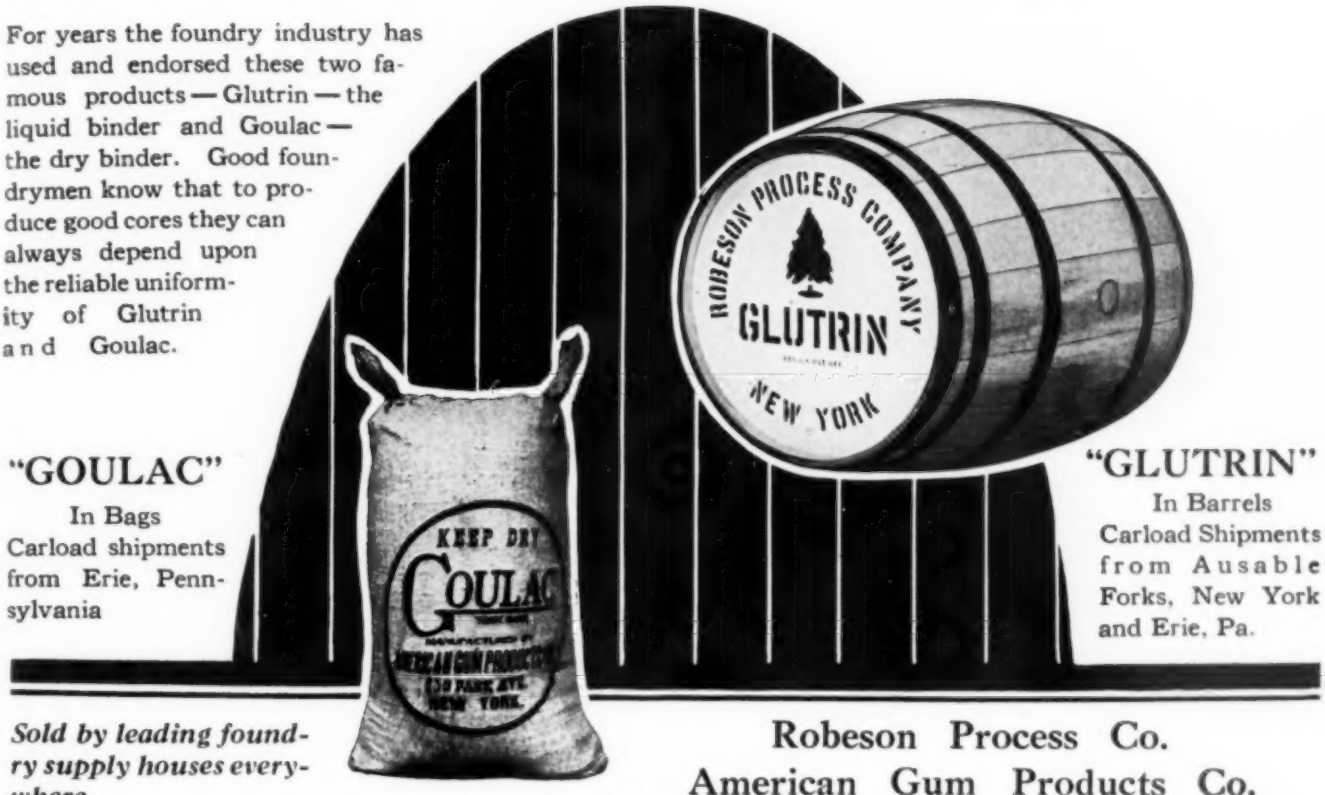
Designs Hand Truck

Fairbanks Co., New York, has introduced a line of hand trucks which combines both wood and metal construction. Special attention has been paid in the design of the truck to provide flexibility with strength.

The trucks also can be equipped with rubber-tired wheels, roller bearings and forced lubrication.

DON'T ACCEPT A SUBSTITUTE!

For years the foundry industry has used and endorsed these two famous products — Glutrin — the liquid binder and Goulac — the dry binder. Good foundrymen know that to produce good cores they can always depend upon the reliable uniformity of Glutrin and Goulac.



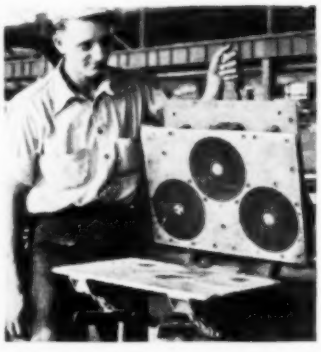
"GOULAC"
In Bags
Carload shipments from Erie, Pennsylvania

"GLUTRIN"
In Barrels
Carload Shipments from Ausable Forks, New York and Erie, Pa.

Sold by leading foundry supply houses everywhere.

Robeson Process Co.
American Gum Products Co.
220 Park Ave. New York

You Save at Every Step . . .



■ Cut core-making costs to the bone. Reduce handling expense. Speed up production. How? By adopting J-M Transite Core Plates.

A specially treated asbestos and cement combination, they are hard to break. After long service, they show little if any warping. And they are *permanently* non-corrosive.

Exceptionally light, too! A core maker carries twice as many with considerably less effort. Labor costs go way down; the core department's production way up.

WRITE FOR FREE BROCHURE. Johns-Manville, 22 E. 40th St., New York City.

Johns-Manville
TRANSITE CORE PLATES

SAND CONTROL

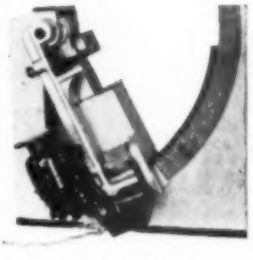
Moisture Permeability Teller

Cut Cost **Increase Sales**

More men work on sand than on any other material in the foundry. Sand tested at time of mixing enables furnishing correct sand to molders. Molders produce a greater number of good molds. Cleaning labor is reduced with tested sand. Scrap Casting Loss is reduced. Salvage labor is reduced. Better castings are furnished customers which increases sales.

Sand, Core and Casting Defect Test Work Solicited.

Write to



Universal Sand Strength Machine Type C. P.

676 W. Grand Blvd. **HARRY W. DIETERT CO.** Detroit, Mich.

Builds Two Types of Vacuum Cleaning Systems

U. S. Hoffman Machinery Corp., air appliance division, 105 Fourth avenue, New York, recently has introduced two types of industrial cleaning systems, one stationary and the other, portable, as shown in the accompanying illustrations. In the stationary type system, dust entering the cleaning nozzles is conveyed to centrally located dust separators through permanently installed piping fitted with inlet valves at convenient locations. It is pointed out that in most industrial plants, the stationary system offers a number of advantages, since more powerful motors and larger exhausters may be used, with dust separators having a greater capacity. Also widely separated parts of the plant may be cleaned simultaneously.

The exhauster housing consists of a series of cast iron sections, with tongue and groove fit held securely in position by tie rods between inlet and outlet end castings. Aluminum alloy impellers are keyed securely to the heavy steel shaft. The assembly is supported between two heavy-duty ball bearings and rotates as a self-contained unit with no internal mechanical wearing parts. The bearing housing design provides for outboard mounting on the end head castings.

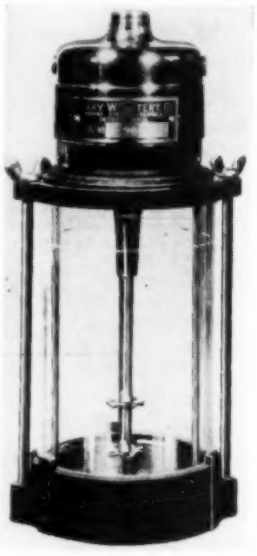
Number of separators used depends upon the nature of the dust, amount to be collected and the manner in which it is finally to be disposed of. Dust laden air enters the primary separator near the top, opposite a circular baffle plate and on a tangent to the circumference. Vortical action, aided by an abrupt reduction in velocity as the air enters the separating chamber, precipitates all heavier matter to the bottom of the chamber. The primary separators are designed to retain from 90 to 95 per cent of the dust entering the system. Only the light fine dust is carried over for final separation. The action of the secondary separator combines the centrifugal separation with a final filtration of air through a number of dust bags located in the upper part of the separator.

Portable units as shown in the accompanying illustration, are built in a complete range of sizes and capacities.

Washes Clay Bond From Grains of Sand

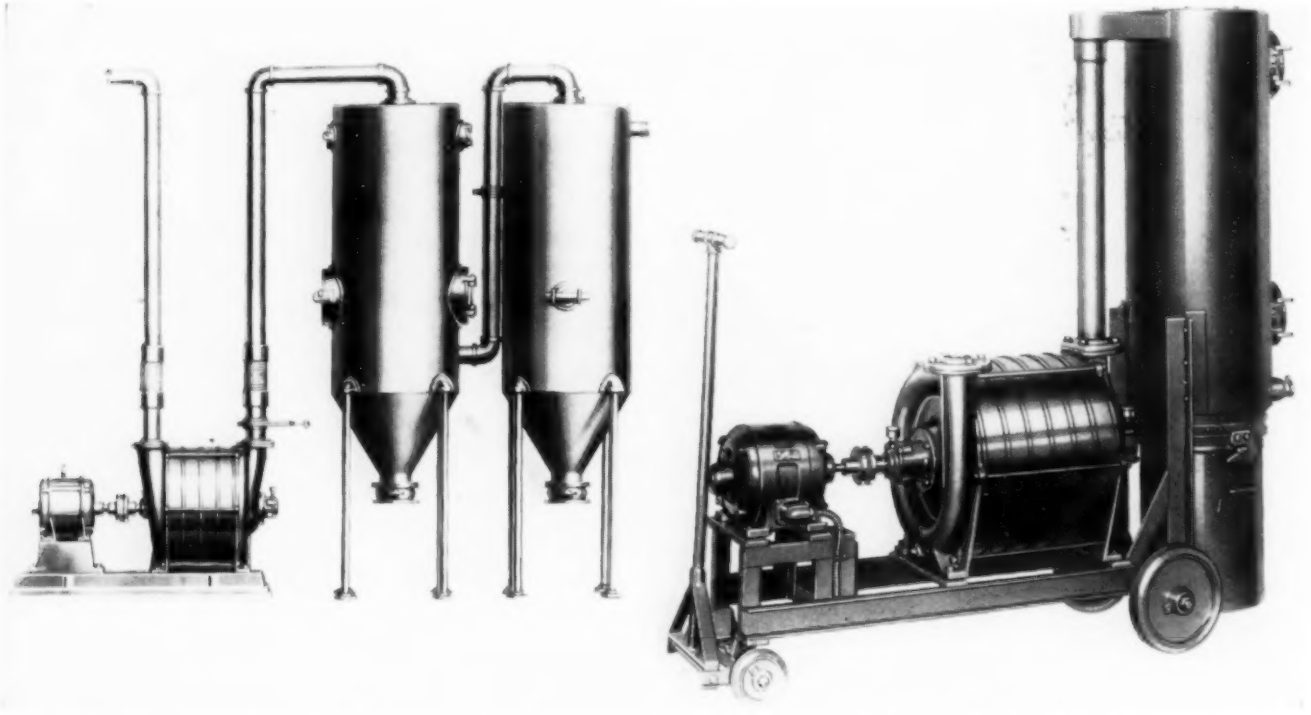
Harry W. Dietert Co., 676 West Grand boulevard, Detroit, has developed a new sand washer for use in foundry sand laboratories to scrub the clay bond free from the grains of molding sand. After the sand is treated for five minutes in the sand washer, which is shown in the accompanying illustration, the motor is lifted from the wash bottle and a suspended clay bond is syphoned off, leaving the sand grains in the bottom of the cup of the wash bottle. The cup then is placed in the oven to dry the sand grains, after which they are weighed.

The percentage of clay is calculated by the difference in weight before treating and after the washing operation. Overall height is 12 inches and the weight is 10 pounds.



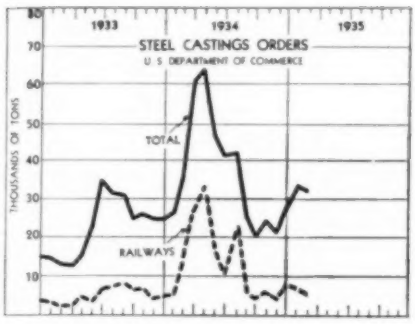
The sand is agitated in the bottle, thus separating the bond from the grains

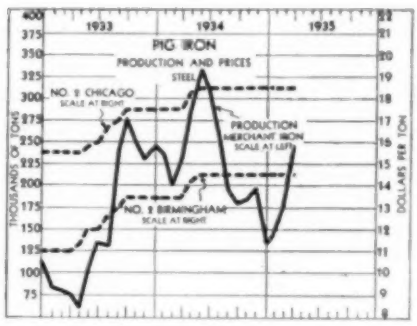
Neville & Cleary, Inc., Title building, Atlanta, Ga., has been appointed sales representative for the Ironton Firebrick Co., Ironton, O., in Tennessee, North Carolina, South Carolina, Alabama, Georgia and Florida.

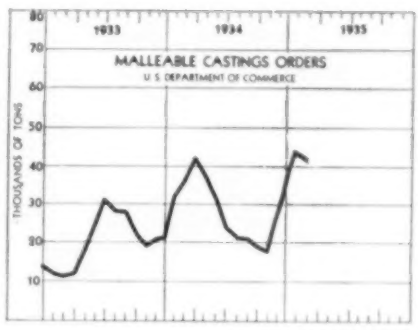


Left—Assembly of stationary type vacuum sweeping system, with primary and secondary dust collectors. Right—Portable type cleaning unit

ADVERTISING PAGES REMOVED







Foundry Activities

Reflect Industrial Trends

FOUNDRY operations in the Chicago district during March held or extended the gains accumulated the preceding several months. While automotive and farm implement castings requirements continued to account for a substantial portion of total activity, demands of most other industries were well maintained. Manufacturers of machine tools, radiation and heating equipment, ingot molds and steel mill rolls continued to experience better operations than a year ago. March pig iron shipments to foundries were the heaviest since last June.

* * *

Elkhart Iron Works, Elkhart, Ind., recently sustained slight damage by fire.

* * *

Plant of the Swayzee Gray Iron Foundry Co., Swayzee, Ind., was destroyed by fire recently.

* * *

Wabash Foundry Co., Wabash, Ind., recently was closed by Elmer Mattern, president.

* * *

Oliver Farm Equipment Co. plant at Sprinfigeld, O., resumed operations March 25, after being idle for several years.

* * *

Birmingham Stove & Range Co., Tennessee Pike, Birmingham, Ala., has a permit to erect an enameling plant at a cost of $5000.

* * *

Index of foundry equipment orders in February was 74.2, as compared with 86.6 in January and 65.8 in February, 1934, according to a recent report of the Foundry Equipment Manufacturers' association, Cleveland. Index of shipments was 85.1 against 76.2 the previous month, and 42.9 during the corresponding period a year ago.

* * *

Output of iron castings in the Philadelphia Federal Reserve district declined in February, according to reports of the industrial research department, University of Pennsylvania. Production of gray iron castings during February was 12 per cent less than in January. Malleable iron production decreased 2.7 per cent while steel castings production increased 4.7 per cent.

* * *

Shamrock Hardware Foundry Corp., Rochester, Ind., has been formed to manufacture gray iron castings by Hiram G. Miller, J. Murray McCarty and Charles C. Campbell.

* * *

Gould Coupler Co. and the Symington Co., both of 250 Park avenue, New York, will be reorganized into one corporation if a plan filed with the federal court is approved.

* * *

Hindale Structural Steel Corp., Brooklyn, N. Y., has been incorporated to operate a foundry and machine shop by Bernard Cohen, Albert Krull, 160 Jamaica avenue, Jamaica, N. Y., and Florence Sloben.

* * *

A. B. Dabney, 125 Easton avenue, Lynchburg, Va., has acquired the former plant of the Hubard Foundry & Machine Works and will operate it as the Dabney Foundry & Machine Works Inc.

* * *

Plant of the Geneva Foundry Corp., Geneva, N. Y., recently sustained severe damages by fire. Operations of the foundry were transferred to the plant of the Summit Foundry Co., Geneva, pending rebuilding.

* * *

Favorite Mfg. Co., Piqua, O., has been organized by W. C. Katker to take over the repair part patterns for all Favorite gas ranges, coal heaters, coal stoves and warm air furnaces from the Favorite Stove & Range

RAW MATERIAL PRICES
April 8, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.10 to $ 5.35
Wise county beehive coke	4.30 to 5.30
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$12.00 to $12.50
Heavy melting steel, Pitts	11.25 to 11.75
Heavy melting steel, Chicago	10.00 to 10.25
Stove plate, Buffalo	9.00 to 9.50
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	7.00 to 7.25
No. 1 cast, mchy., Chicago	9.00 to 9.50
No. 1 cast, Pittsburgh	11.50 to 12.00
No. 1 cast, Philadelphia	11.50 to 12.00
No. 1 cast, Birmingham	8.50 to 9.00
Car wheels, iron, Pittsburgh	12.00 to 12.50
Car wheels, iron, Chicago	10.50 to 11.00
Railroad malleable, Chicago	13.00 to 13.50
Malleable, Buffalo	12.00 to 12.50
Nonferrous Metals	
	Cents per pound
Castings copper, refinery	7.60 to 7.75
Straits tin	49.45
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary)	16.50 to 17.25
Lead, New York	3.65
Antimony, New York	14.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.00

Co., Piqua, which has been liquidated. The company also will manufacture cook and heater type stoves and warm air furnaces. Mr. Katker formerly was president of the Favorite Stove & Range Co.

* * *

Dortch Stove Works, Franklin, Tenn., has plans for one-story addition, totaling about 12,000 square feet floor space, primarily for storage and distribution. Cost close to $25,000 with equipment.

* * *

Keeler Brass Co., Grand Rapids, Mich., has acquired former factory of Standardized Furniture Co., totaling about 44,000 square feet of floor space, and will occupy part of the structure for expansion in storage and distributing division.

* * *

American Brake Shoe & Foundry Co., New York, has purchased the plant and equipment of the Railway Materials Corp., Toledo, O. The plant will be known as the Toledo plant of the American Brake Shoe & Foundry Co. and will be operated under the direction of W. H. Winters, vice president in charge of operations.

Loan Declined

AN ITEM in the March issue of THE FOUNDRY stated that the RFC had granted a loan of $20,000 to the Auburn Foundry, Inc., Auburn, Ind. This was prepared from a news release of the RFC. It now develops that due to the length of time required by the RFC to act on the application for the loan, the need had passed, and the loan, when authorized, was declined by the Auburn Foundry.

New Trade Publications

BUCKET ELEVATORS — Jeffrey Mfg. Co., Columbus, O., recently has published its catalog No. 565 devoted to its line of bucket elevators for a wide variety of elevating requirements. Engineering data are given on design, application and operation, as well as consideration in the selection of a standard elevator. Illustrations show details of construction for various applications.

SAFETY INFORMATION — Mine Safety Appliances, Co., Braddock, Thomas & Meade streets, Pittsburgh, has prepared a publication "Carbon Monoxide, the Killer", which discusses the cause of the fourth largest group of occupational diseases, accidents and deaths. Equipment which may be used to prevent this hazard is described and illustrated.

GATE VALVES—Fairbanks Co., New York, has published a bulletin on its line of renewable gate valves. Information is given on construction and methods of renewing the valves.

ELECTRICAL EQUIPMENT—Allen-Bradley Co., Milwaukee, Wis., has published the first edition of a new catalog covering its wide line of electrical equipment.

INDUSTRIAL CABLE — General Electric Co., Schenectady, N. Y., has published a catalog on its line of standard types of insulated wire and cable used for transmission and distribution and control.

SANDSLINGER—Beardsley & Piper Co., 2541 North Keeler avenue, Chicago, has published a folder on its new swing type sandslinger which provides a flexible molding unit for a wide variety of uses. Drawings show methods of using the equipment.

PROTECTIVE MASKS — Martindale Electric Co., Cleveland, has published a folder illustrating the use of its line of protective masks in a wide variety of industries. The mask is designed for protection against dusts, mists and fumes.

STOKERS—Whiting Corp. underfeed stoker division, Harvey, Ill., has published a bulletin on the application of its underfeed stoker to core drying ovens. It is pointed out that equipped with automatic thermostatic controls, the stoker will permit regulation of the oven temperature within a total variation of 15 degrees Fahr.

ROOFS—A recent booklet of Johns-Manville, 22 East Fortieth street, New York, deals extensively with the problem of construction and maintenance of roofs for industrial and business buildings. Considerable space also is devoted to discussion of roof insulation and its effect on reducing fuel costs, improving working or living conditions on upper floors, and in providing protection to both roof deck and roofing felts.

TOOLS — Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has published a catalog on its power vane rotary tools, which includes drills, grinders, wrenches, woodborers, etc. Various tools are illustrated and data are given on specifications.

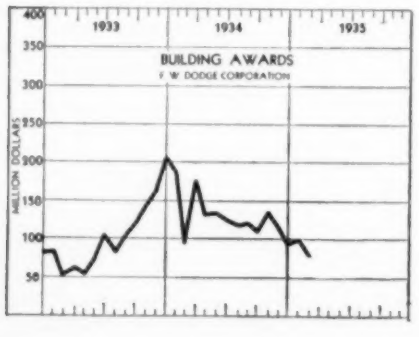
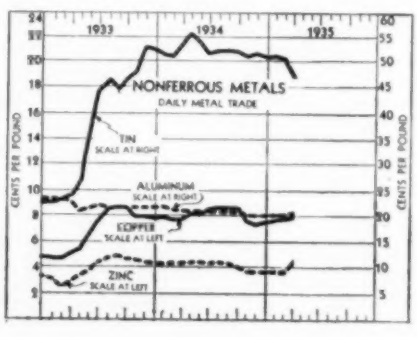
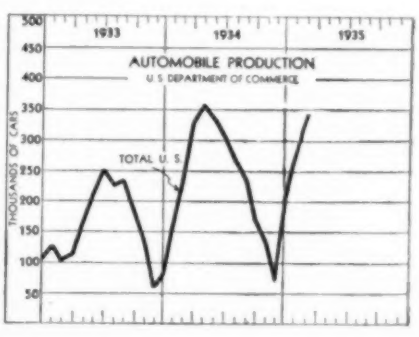
BLAST CLEANING — W. W. Sly Mfg. Co., 4706 Train avenue, Cleveland, has published a bulletin on the Masterblast equipment for cleaning castings. Illustrations show the equipment ready for receiving the work to be cleaned, the method of drive, the bearing support, and the unit in operation.

RUBBER GOODS—B. F. Goodrich Co., mechanical division, Akron, O., recently has published a new booklet of engineering data designed to simplify the selection of belting, hose and other mechanical rubber goods for industrial service. The book describes over 200 rubber items and contains more than 100 different diagrams and illustrations.

REDUCERS — Link-Belt Co., 910 South Michigan avenue, Chicago, has published a catalog No. 1515 devoted to its newly developed line of speed reducers, in which the motor is mounted directly on the side of the reducer housing. The text shows how the proper reducer can be selected from tables which give dimensions, capacity rating and speed ratios.

PIPE—Cast Iron Pipe Research association, 122 South Michigan avenue, Chicago, recently has published an interesting booklet entitled "Service Records of Existing Cast Iron Mains Laid in the 17th, 18th and 19th Centuries." The text illustrates early pipe installation in the United States and also in England, France, Germany. Several installations in American cities have been in use for over 100 years.

In accordance with the Trade Practice Provisions of the Code for Periodical Publishing and Printing Industry the following constitutes "Publisher's Statement of Circulation."

This is to certify that the average circulation per issue of THE FOUNDRY for the six months' period July 1st to and including December 31st, 1934, was as follows: Copies sold, 4708. Copies distributed free, 1332. Total 6040. Signed —J. D. Pease, for (Publisher).

Subscribed to and sworn before me on this 22nd day of March, 1935. H. L. Richey, Notary Public. My commission expires May 7, 1936.